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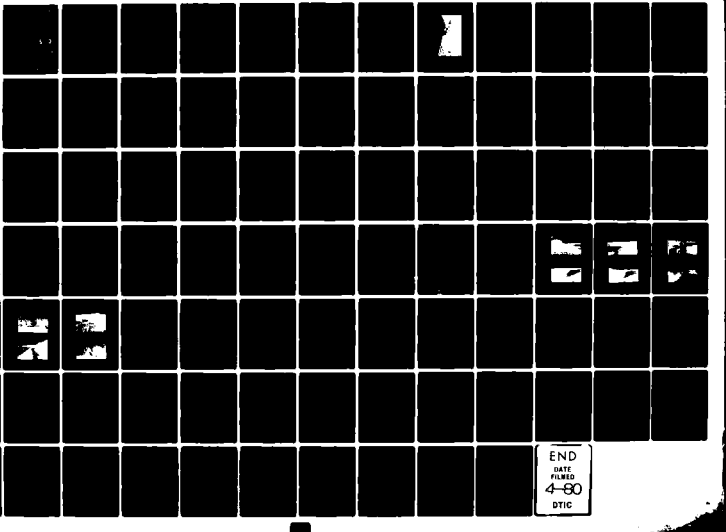

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DELAWARE RIVER BASIN
CLEAR RUN, MONROE COUNTY

PENNSYLVANIA

LYNCHWOOD LAKE DAM

NDI ID NO. PA-00773
DER ID NO. 45-38

LYNCH CORPORATION

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

ORIGINAL CONTAINS COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE

Prepared by
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
Harrisburg, Pennsylvania 17105

For
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

JANUARY 1980

DELAWARE RIVER BASIN

CLEAR RUN, MONROE COUNTY

PENNSYLVANIA

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For

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Baltimore District, Corps of Engineers
Baltimore, Maryland 20203

JANUARY 1980

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

DELAWARE RIVER BASIN

CLEAR RUN, MONROE COUNTY

PENNSYLVANIA

LYNCHWOOD LAKE DAM

(NDI-ID Number PA-00773
DER-ID No. 45-38)

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

JANUARY 1980

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APPENDICES

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam:	Lynchwood Lake Dam NDI ID No. PA-00773 DER ID No. 45-38
Size:	Small (20 feet high; 380 acre-feet)
Hazard Classification:	High
Owner:	Lynch Corporation Tobyhanna, Pa. 18466
State Located:	Pennsylvania
County Located:	Monroe
Stream:	Clear Run
Date of Inspection:	22 October 1979

Based on visual inspection, available records, calculations, past operational performance, and according to criteria established for these studies, Lynchwood Lake Dam is judged to be unsafe, non-emergency, because the spillway capacity is rated as seriously inadequate. The existing spillways can pass only 14 percent of the Probable Maximum Flood (PMF) before flow occurs around the right end of the dam and only about 25 percent of the PMF before general overtopping of the dam occurs. Based on the type of construction and the condition of the dam, it is judged that the dam could not withstand the depth and duration of overtopping that would occur for the 1/2 PMF. Failure of the dam would cause an increased hazard for loss of life downstream. As a whole, the dam is judged to be in poor condition.

The structural integrity of the dam is suspect because of the type and age of the dam, and because there were visible signs of structural deterioration and distress. The extent of the hazard cannot be assessed because of the lack of data concerning the design and construction.

The outlet conduit has deteriorated to the extent that it causes a potential hazard to the dam.

The following measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Perform additional studies to more accurately ascertain the spillway capacity required for Lynchwood Lake Dam as well as the nature and extent of mitigation measures required to provide adequate spillway capacity. The studies should also assess the need for an outlet channel for the existing auxiliary spillway. Take appropriate action as required.

(2) Perform comprehensive investigations and studies as required to assess the structural stability and any potentially hazardous conditions that might exist for the dam and the main spillway. The investigations and studies should address conditions within the dam, foundation, and outlet works. Take appropriate action as required.

(3) Other deficiencies that were noted during the inspection should be addressed in formulating plans of remedial action.

(4) Until investigations, studies, and remedial work are completed, the Owner should monitor the condition of the dam and appurtenant structures. Take appropriate action as required should any changes in conditions occur.

All investigations, studies, designs, and supervision of construction should be performed by a professional engineer experienced in the design and construction of dams. Monitoring programs should also be performed or supervised by a professional engineer.

In addition, it is recommended that the Owner modify his operational procedures as follows:

(1) Develop a detailed emergency operation and warning system for Lynchwood Lake Dam.

(2) During periods of unusually heavy rains, provide round-the-clock surveillance of Lynchwood Lake Dam.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the owner should activate his emergency operation and warning system procedures.

(4) Institute an inspection program such that the dam is inspected frequently. As presently required by the Commonwealth, the program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the results to determine if remedial measures are necessary.

(5) Institute a maintenance program to properly maintain all features of the dam.

Submitted by:

JANNETT FLEMING CORBETT
AND CARPENTER, INC.

FREDERICK KUPSCO
Project Manager, Dam Section

Date: 11 February 1980

Approved:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 29 Feb 1980

LYNCHWOOD LAKE DAM

Overview

DELAWARE RIVER BASIN

CLEAR RUN, MONROE COUNTY

PENNSYLVANIA

LYNCHWOOD LAKE DAM

NDI ID No. PA-00773
DER ID No. 45-38

LYNCH CORPORATION

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JANUARY 1980

SECTION 1

PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Lynchwood Lake Dam is 1,685 feet long and 20 feet high at its maximum section. The dam has an irregular alignment and consists of a rock-filled, timber crib dam about 1,275 feet in length, flanked on each end with reaches of embankment. A dry, stone masonry wall is located along the downstream side of the timber crib section, and there is an earthfill section upstream from the timber crib.

The main spillway is located in the timber crib section of the dam near the original streambed location. It is a broadcrested weir with three concrete steps. The weir is 26.6 feet long and has a 1.4-foot wide pier at its center. The weir crest is 2 feet lower than the top of the dam. A concrete apron is located at the downstream toe of the main spillway.

An auxiliary spillway is located near the left abutment of the dam. The auxiliary spillway consists of a reach of earthen embankment lined with concrete on its downstream side and with riprap on its upstream side. The crest is protected by vegetation. A wood sheeting cutoff of unknown depth is located at the upstream end of the concrete lining. The crest of the auxiliary spillway is 205.6 feet long and is 0.9 foot lower than the top of the dam. There is no defined outlet channel for the auxiliary spillway.

The outlet works is located at the left abutment of the main spillway and consists of an intake structure and a 36-inch diameter steel conduit. The intake structure is made of timber and concrete. The outlet works has no gate, and conduit flow is controlled by using stoplogs.

The various features of the dam are shown on the Photographs in Appendix C and on the Plates in Appendix E. A description of the geology is presented in Appendix F.

b. Location. Lynchwood Lake Dam is located on Clear Run in Coolbaugh Township, Monroe County, Pennsylvania, approximately 2.5 miles southeast of Tobyhanna. The dam is shown on USGS Quadrangle, Tobyhanna, Pennsylvania, at latitude N 41° 08' 45" and longitude W 75° 23' 25". A location map is shown on Plate E-1.

c. Size Classification. Small (20 feet high, 380 acre feet).

d. Hazard Classification. High hazard. Downstream conditions indicate that a high-hazard classification is warranted for Lynchwood Lake Dam. (Paragraphs 3.1e and 5.1c (5)).

e. Ownership. Mary Lou Miller, Lynch Corporation, Tobyhanna, Pennsylvania 18466.

f. Purpose of Dam. Recreation.

g. Design and Construction History. Little is known about the design or construction of the original features of the dam. The age of the dam is unknown, but the records show that it was constructed prior to 1919. The dam is believed to have been built by the Lynchwood Ice Company. The dam was constructed in three segments, two earthen and/or rockfill sections with a timber crib main section between them. The timber crib section is reported to have consisted of a vertical, rock-filled, timber crib with vertical wooden sheeting and earthfill upstream, and a dry, stone masonry wall downstream. Early photographs indicate that the earthen embankment section located to the left of the main spillway also had vertical, wooden sheeting. The original main spillway was a timber crib structure with three steps on its downstream side. The original outlet works was located at the left abutment of the main spillway and consisted of two 36-inch diameter steel pipes.

By 1920, the lower two steps of the spillway had partly collapsed and the earthfill on the upstream side of the wooden sheeting had settled to a maximum depth of two feet below the top of the sheeting. The Pennsylvania Water Supply Commission (PWSC) ordered the deficiencies be repaired. The spillway was reconstructed that same year, but there is no information available that describes either the design or the method of construction. It is not clear whether the concrete of the main spillway was massive in section or whether it was a lining placed over other material. The main spillway, as it now exists, appears to be the same structure that was constructed in 1920.

In 1927, an inspection by the PWSC noted a number of deficiencies (Appendix A). In conjunction with other repairs, the PWSC recommended increasing the

spillway capacity. By April 1929, the Dunning Engineering Company completed plans to provide an auxiliary spillway 210 feet long near the left abutment. The top of the dam was to be raised and leveled to provide 2 feet of head at the main spillway and 1.5 feet of head at the auxiliary spillway. The auxiliary spillway was to be lined with riprap. Records indicate that the auxiliary spillway was constructed sometime prior to 1938, and that a concrete lining was placed on its downstream side instead of riprap, as was originally proposed. Measurements made during the visual inspection show that the existing available heads are 2 feet for the main spillway and 0.9 foot for the auxiliary spillway.

At an unknown time, the lower 36-inch diameter outlet conduit was apparently removed. The methods of removal of the pipe and subsequent repair of the resulting void are unknown. In recent years, the intake structure was reconstructed by the present Owner, Lynch Corporation.

h. Normal Operational Procedure. The pool is maintained at or slightly below the main spillway crest level with excess inflow discharging through the outlet conduit and the main spillway. Releases from the outlet works, as well as spillway discharges, flow downstream to Stillwater Lake and Lake Naomi.

1.3 Pertinent Data.

a.	Drainage Area. (square miles)	3.4
b.	Discharge at Damsite. (cfs.)	
	Maximum known flood at damsite	Unknown
	Outlet works at maximum pool elevation	169
	Spillway capacity at maximum pool elevation	
	Main	192
	Auxiliary	544
	Combined	736
c.	Elevation. (Feet above msl.)	
	Top of dam	1882.7
	Maximum pool	1882.7
	Normal pool (main spillway crest)	1880.7
	Upstream invert outlet works	1867.0
	Downstream invert outlet works	1866.7
	Streambed at toe of dam	1862.9

d. Reservoir Length. (miles)

Normal pool	0.29
Maximum pool	0.34

e. Storage. (acre-feet)

Normal pool	285
Maximum pool	380

f. Reservoir Surface. (acres)

Normal pool	44
Maximum pool	51

g. Dam.

Type	Timber crib main section; two embankment sections.
Length (feet)	1,685
Height (feet)	20
Topwidth (feet)	Varies 6 to 14
Sides Slopes	
Upstream	Varies
Downstream	Varies
Zoning	Unknown
Cut-off	Unknown
Grout Curtain	Unknown

h. Diversion and Regulating Tunnel. None

i. Spillway.

Type	
Main	Broadcrested weir with concrete steps.
Auxiliary	Protected embankment over-flow section
Length of Weir (feet)	
Main	26.6 with 1.4-foot wide pier
Auxiliary	205.6

i. Spillway. (Cont'd.)

Crest Elevation	
Main	1880.7
Auxiliary	1881.8
Upstream Channel	
Main	Reservoir.
Auxiliary	Reservoir.
Downstream Channel	
Main	Concrete apron and stream channel.
Auxiliary	No defined channel.

j. Regulating Outlets.

Type	One 36-inch diameter steel conduit
Length (feet)	25
Closure	Wooden stop-logs at intake structure.
Access	Top of dam.

SECTION 2

ENGINEERING DATA

2.1 Design.

a. Data Available. Engineering data available for review were minimal. The only available data are the exterior lines and grades at several locations, which were determined during this inspection, and the general descriptions of the features. Nothing is known about either the foundation conditions or the details of the various materials within the dam. Only one drawing was available, and it showed proposed construction for the auxiliary spillway. It did not provide any significant engineering information and did not represent as-built conditions.

b. Design Features. The project is described in Paragraph 1.2a. The various features of the dam are shown on the Photographs in Appendix C and on Plate E-2 in Appendix E. The dam is shown on Photographs A through J. The spillways are shown on Photographs K and L. The outlet works is shown on Photographs M and N.

c. Design Considerations. Although design data is meager, concern for safety exists due to the nature of the design and due to the age of Lynchwood Lake Dam. The dam is at least 60 years old. After 60 years, it is reasonable to assume that major repairs would be needed for a timber crib dam. The likelihood of deterioration of the timbers is high. When the dam consists solely of an exposed timber crib, the need for repairs is easily determined by visual inspection. Lynchwood Lake Dam is a timber crib dam with upstream earthfill and a downstream dry, stone masonry wall, and the condition of the timber crib structure cannot be determined as easily. Considering the age of the dam, the condition of the timber crib section of Lynchwood Lake Dam is suspect and the structural integrity questionable.

2.2 Construction.

a. Data Available. There were no construction data available for Lynchwood Lake Dam.

b. Construction Considerations. The available information is not sufficient to assess the construction of the dam.

2.3 Operation. There are no formal records of operation maintained by the Owner. A record of operation exists in the form of reports of inspections made by the Commonwealth between 1919 and 1944. A summary of the findings is presented in Appendix A. There have been significant deficiencies that developed over the life of the dam. Some of the deficiencies were corrected, and others were not. A general review of the record of operation indicates inadequate maintenance during the period from 1919 to 1944.

2.4 Evaluation.

a. Availability. Engineering data were provided by the Bureau of Dams and Waterway Management, Department of Environmental Resources, Commonwealth of Pennsylvania. The Owner made available the caretaker for information during the visual inspection. He also researched his files for information at the request of the inspection team.

b. Adequacy. The type and amount of available design data and other engineering data are limited, and the assessment must be based on the combination of available data, visual inspection, performance history, hydrologic assumptions, and hydraulic assumptions.

c. Validity. There is no reason to question the available data.

SECTION 3

VISUAL INSPECTION

3.1 Findings.

a. General. The overall appearance of the dam is poor. Deficiencies were observed as noted below. A sketch of the dam with the location of deficiencies is presented in Appendix B on Exhibit B-1. Survey information acquired for this report is summarized in Appendix E. The primary inspection of the dam was performed on 22 October 1979. On 15 November 1979, the inspection team returned to the site to retake some photographs. Additional brush had been cut by that time, and the pool was lower than during the primary inspection. The Photographs in Appendix C and the description herein are from both visits to the site.

b. Dam. Riprap on the upstream slopes of the embankment sections of the dam is generally intact. The riprap does not extend to the top of the dam, but no areas of wave erosion above the level of the riprap were apparent (Photograph A). Most of the brush growing on the upstream slope was removed before the second inspection. Part of the timber crib is exposed over the central section of the dam (Photographs B, C, and D). The condition of the logs that were visible ranged from poor to good. Generally, the logs located at or above the normal pool level are in poor to fair condition, and logs below normal pool level are in fair to good condition. No evidence of wooden sheeting along the upstream side of the cribbing was visible. Levels of fill on the upstream side of the cribbing vary from nearly at the top of the cribbing (Photograph B) to 5 feet or more lower than the top of the cribbing (Photograph C). Some single logs are displaced at various locations. At one area, located approximately 200 feet right of the main spillway, a reach exists where the cribbing has failed and caused a large bulge (Photograph D). One unusual depression was observed on the upstream slope approximately 140 feet right of the main spillway. The depression is located in the earthfill above the timber crib and is approximately 2 feet in diameter and 1.5 feet deep.

The top of the dam is irregular in both width and elevation. The top width varies from 6 feet to 14 feet, and the top elevation varies from Elevation 1882.7 to Elevation 1885.2. A profile and surveyed cross sections of the dam are shown on Plate E-2. The lowest point is located at the right abutment (Photograph E). It appeared that overflow of water at this section would result in flow along the toe of the dam. Brush removal from the top of the dam was in progress at the time of the first inspection (Photo-graph F), and was nearly complete by the time of the second visit to the site.

The downstream slope of the embankment section located to the right of the timber crib section was covered with heavy brush and trees, because the brush removal operations had not yet been completed at the time of the second visit to the dam. The downstream side of the timber crib section consists of a dry, stone masonry wall having a slope approximately 2V on 1H. Additional earthfill is located above the top of the dry, stone masonry wall. Typical sections are shown on Plate E-2 in Appendix E. The dry, stone masonry wall is shown on Photographs G through K. The surface of the wall is very irregular. In three locations, small slides of the downstream wall have occurred. The locations of these slides are shown on Exhibit B-1, and two of the slides are shown on Photographs H and I. The third slide is similar in appearance to the other two.

Clear seepage was observed at 10 locations along or near the downstream toe of the dam, particularly in the vicinity of the maximum section. The locations of the seepage areas and the approximate quantities of seepage are shown on Exhibit B-1. Several soft, wet areas were also located along or near the toe. The locations of those areas are also shown on Exhibit B-1.

c. Appurtenant Structures. The main spillway appeared to be in fair condition (Photograph K). Although cracks in the concrete are numerous, there seemed to be no loose pieces of concrete. There were no signs of differential movement at the cracks or other signs of distress. The crest elevation varied by 0.6 foot from one side of the structure to the other. The concrete apron at the toe of the main spillway was submerged and could not be inspected in detail.

The auxiliary spillway is shown on Photograph L. The upstream slope and the crest are in satisfactory

condition. The concrete lining on the downstream slope has a number of surface cracks, but no significant structural deficiencies were apparent. At the right abutment of the auxiliary spillway, there is a hole about 1 foot in diameter at the top of the embankment adjacent to the spillway sidewall. The sidewalls were lower than the adjacent embankment level. The auxiliary spillway has no defined outlet channel. It was observed that discharge would enter a wooded area and flow along a swale that is approximately parallel to the dam. Flow patterns would be complicated by an irregular pile of loose rock located about 30 feet downstream from the auxiliary spillway.

The outlet works is located along the left side of the main spillway. The intake structure is a timber and concrete structure located at the upstream side of the dam (Photograph M). Conduit flow is controlled by using wooden stoplogs at the intake structure. The intake structure appeared to be in good condition. The outlet conduit, a 36-inch diameter steel pipe, was in poor condition (Photograph N). Although flowing water prevented detailed inspection of the conduit, inspection from the outside indicated severe deterioration of its lower half for an estimated distance of 10 feet into the dam. No erosion was apparent at the bottom of the free overfall.

d. Reservoir Area. The watershed area has significant amounts of residential development, but it remains nearly all wooded. Swampy areas are common in the watershed, and a small natural lake is within its bounds. Slopes surrounding the reservoir area are mild.

e. Downstream Channel. The area immediately downstream from Lynchwood Lake Dam is a broad, wooded valley. Hawkey Pond, a very small impoundment, is located about 0.4 mile downstream from Lynchwood Lake Dam. A 22-foot high railroad embankment also crosses the stream, known at that point as Hawkey Run, at Hawkey Pond. The railroad embankment, which is about 50 feet wide at its top, has a horseshoe conduit 14 feet wide by 14 feet high. Two low-lying houses are located near the stream approximately 0.1 mile downstream from the culvert. Further downstream, between 0.7 mile and 1.0 mile from the dam, are 6 more low-lying houses. At a distance of 1.3 miles downstream, Hawkey Run flows through a large bridge opening under Interstate Route 380. Where Hawkey Run enters Stillwater Lake, about 1.5 miles downstream from the dam, is another cluster of 5 low-lying houses.

Upon leaving Stillwater Lake, the name of the stream becomes Upper Tunkhannock Creek, which, at a distance of 3.8 miles from the dam, enters Lake Naomi. Lake Naomi Dam is located 5.5 miles downstream from Lynchwood Lake Dam. The downstream conditions are shown on Exhibit D-1 in Appendix D.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure. The reservoir is maintained at or below the main spillway crest level with excess inflow discharging through the outlet conduit and/or over the main spillway and into the downstream channel. The outlet works is used to drawdown the pool level each winter to protect recreational facilities.

4.2 Maintenance of Dam. The dam is visited occasionally by a caretaker for Lynch Corporation, which operates a summer camp adjacent to Lynchwood Lake. The caretaker stated that he is on the site every day. Formal inspections of the dam are not made. Maintenance of the dam, except for the recent cutting of brush, has been minimal.

4.3 Maintenance of Operating Facilities. The intake structure is maintained as needed. Stoplogs are removed in the fall and replaced in the spring.

4.4 Warning Systems in Effect. The caretaker stated that he was not aware of any emergency operation and warning system in effect. He said that the condition of the dam is monitored during floods.

4.5 Evaluation of Operational Adequacy. The maintenance of the project has been minimal and, in some areas, inadequate. Inspections are necessary to detect hazardous conditions at the dam. An emergency operation and warning system is necessary to reduce the risk of dam failure should adverse conditions develop and to prevent loss of life downstream should the dam fail.

SECTION 5

HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. Records indicate that in 1927 the Pennsylvania Water Supply Commission requested that the spillway capacity be increased to 1,600 cfs. Although plans were prepared and substantial work was performed, it does not appear that the work was completed.

b. Experience Data. No records of maximum pool levels were available. The 1955 flood resulting from Hurricane Diane is believed to be the flood of record. The Owner stated that the dam was not overtopped during that flood.

c. Visual Observations.

(1) General. The visual inspection of Lynchwood Lake Dam, which is described in Section 3, resulted in a number of observations relevant to hydrology and hydraulics. These observations are evaluated herein for the various features.

(2) Dam. The existing spillway capacity determined for this study is based on the combined capacity of the main and auxiliary spillways. The spillway capacity is limited by a low area (El. 1882.7) at the right abutment. Flow through the low area would travel along the toe of the dam. Although damage might result from relatively small discharges around the right end of the dam, it was uncertain whether failure of the dam would be a possible consequence. For this reason, the pool level at which dam failure might occur was assumed to be at the level at which general overtopping of the dam would occur, Elevation 1883.2. In evaluating conditions at the dam, slightly lower elevations that exist immediately adjacent to each end of the main spillway were ignored. The quantity of flow at each end would be minimal, and the dry, stone masonry walls were judged to be capable of withstanding the flow.

(3) Appurtenant Structures. The crest elevations of both the main and auxiliary spillways vary. In the analysis performed for this Report, average crest

elevations were used. Such a simplification has a negligible effect on the results of the analysis.

Although cracks in the concrete exist for both the main and the auxiliary spillways, it did not appear that spillway discharge would cause damage to the structures.

As noted in Section 3, the auxiliary spillway has no defined outlet channel. It appeared that discharge would flow in a direction roughly parallel to the toe of the dam toward the natural stream channel, but the extent of any possible hazard to the dam that might result from large discharges could not be accurately assessed during the visual inspection.

The outlet works conduit has deteriorated to the extent that it creates a potential hazard to the dam.

(4) Reservoir Area. No conditions were observed in the reservoir area that might present significant hazard to the dam. The small lake located upstream from the dam is not considered to have significant effects on the hydrology.

(5) Downstream Conditions. No conditions were observed downstream from the dam that would affect the hydraulics of the dam. If the dam should fail, a hazard would exist to at least 8 dwellings located along Hawkey Run. The railroad embankment that is located between the dam and the dwellings was considered in the hydraulic analysis. Because of the possibility of flooding dwellings, a high hazard classification is warranted for Lynchwood Lake Dam.

d. Overtopping Potential.

(1) Spillway Design Flood. According to the criteria established by the Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) for the size (Small) and hazard potential (High) of Lynchwood Lake Dam is between the 1/2 Probable Maximum Flood (PMF) and the PMF. Because of the downstream conditions and the height of the dam, the PMF is selected as the SDF for Lynchwood Lake Dam. The watershed was modeled with the HEC-1DB computer program. A description of the model is included in Appendix D. The assessment of the dam is

based on existing conditions, and the effects of future development are not considered.

(2) Summary of Results. Pertinent results are tabulated at the end of Appendix D. The analysis reveals that Lynchwood Lake Dam can pass 14 percent of the PMF before flow occurs around the right end of the dam and approximately 25 percent of the PMF before general overtopping of the dam occurs. The dam is rated at its existing top elevation as described in Paragraph 5.1c(2).

(3) Spillway Adequacy. The criteria for rating a spillway is presented in Appendix D. Because an occurrence of the 1/2 PMF would result in overtopping of the dam, a further analysis was performed. It was assumed that Lynchwood Lake Dam would begin to fail during the 1/2 PMF when general overtopping of the dam began. The railroad embankment would be overtopped by 3.8 feet, provided that it did not fail by overtopping also. When routed downstream to the first group of dwellings, the flow would raise water levels by about 2 feet over the water surface that existed just prior to failure of the dam. If the railroad embankment were to fail, the rise in water surface levels would be significantly greater. Failure of the dam would cause an increased hazard for loss of life. The spillway capacity is, therefore, rated as seriously inadequate.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) General. The visual inspection of Lynchwood Lake Dam, which is described in Section 3, resulted in a number of observations relevant to structural stability. These observations are evaluated herein for the various features.

(2) Dam. Wave erosion above the top of the riprap has apparently not been a problem at Lynchwood Lake Dam. It has probably not occurred because the reservoir fetch length is short (0.3 mile) and because a heavy growth of brush and trees existed until recently. The brush and trees, while inhibiting erosion, are not satisfactory as slope protection for dams because of possible damage from root systems. In addition, the brush and trees, which were recently removed, prevented development of satisfactory slope protection such as a thick stand of grass. In its present condition, the portion of the dam above the riprap is not adequately protected.

The inspection of the timber crib structure indicated that it has undergone structural deterioration. Deteriorated and displaced individual logs and a general failure at one location indicate potentially serious structural deterioration. Associated problems include apparent deterioration of timber sheeting that once existed along the upstream side of the crib and the very irregular level of the earthen fill material along the upstream side. The reported purpose of the sheeting was to reduce seepage. With some of the sheeting gone, additional seepage could possibly have resulted in rotting of timbers within the dam that for many years were kept dry. Maintaining a uniform level of fill material upstream from the crib has been documented as a problem since 1919. At that time, the level of the fill was reported to have settled by 2 feet at some locations. Later inspections document similar conditions although additional fill was placed at least once. A comparison of photographs of the same reach of the upstream side of the dam shows that in 1927 the timber crib was completely covered by fill material, but in 1979 the crib was exposed

and the level of fill material was about 5 feet lower than the top of the crib. A full explanation of this condition is not possible because of lack of information concerning design of the dam and concerning composition of the fill material. Possible causes include wave erosion and/or migration of fine soil into the crib section followed by settlement. Regardless, a reduction of fill material upstream from the timber crib increases the concern for the stability of the dam.

The dry, stone masonry wall located on the downstream side of the dam is steep and very irregular. Whether the irregularity is the result of original construction or bulges that might have developed since construction cannot be determined. The small slides that were observed at the wall appeared to be shallow in depth and were limited in extent. Records indicate that two of the slides probably occurred prior to 1920 and that the third occurred in 1938. The cause of the last slide was attributed to damage caused by fishermen. The degree of dependence of the stability of the dam as a whole on the continuity of the dry, stone masonry wall cannot be assessed with existing data.

Clear seepage was observed along the toe of the dam at numerous locations, especially in the vicinity of the main spillway. Soft, swampy areas were also extensive. Available records document the existence of seepage as early as 1921, but descriptions of locations and quantities are inadequate for conclusive comparison with existing conditions. The descriptions of past seepage and swampy areas seem to generally correspond with observations made during this inspection. Possible effects of the seepage cannot be assessed with the existing data. The depression that was noted on the top of the dam did not appear to be of recent origin. It might or might not be indicative of other problems.

(3) Main Spillway. Seepage and swampy areas in the vicinity of the main spillway are described and evaluated elsewhere. A survey of the crest of the main spillway showed 0.6 foot difference in elevation between the two ends of the 26.6-foot wide structure. Whether the difference is due to original construction or later settlement cannot be determined.

(4) Outlet Works. The condition of the outlet works conduit could have an adverse effect on stability.

Further deterioration could lead to internal erosion of the dam or to collapse of the conduit, which would threaten the stability of the dam.

b. Design and Construction Data. There are no stability analyses available for Lynchwood Lake Dam. Available records provide a general description of the design, but there are no cross sections of the dam or main spillway. As discussed in Paragraph 2.1c., there is concern for stability because of the age of the timber crib structure. The stability of the main spillway cannot be assessed from existing data.

c. Operating Records. There are no formal records of operation. Previous inspection reports document failure of a portion of the original spillway structure and collapse of the downstream dry, stone masonry wall at several locations.

d. Postconstruction Changes. Records indicate that the main spillway was reconstructed in 1920, but no details of the work are available. An auxiliary spillway was constructed and the dam was raised during the 1930's, but records indicate that the work was never entirely completed. At an unknown time, a second outlet conduit, located immediately below the existing conduit, was apparently removed. The Owner reported that there have been no significant changes in the condition of the dam or appurtenant structures in recent years.

e. Seismic Stability. Since the structural stability of the dam is questionable, it is assumed that the dam could not withstand an earthquake.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety.

(1) Based on available records, visual inspection, calculations, and past operational performance, Lynchwood Lake Dam is judged to be in poor condition. Based on existing conditions, the spillways will pass 14 percent of the PMF before flow occurs around the right end of the dam and about 25 percent of the PMF before general overtopping of the dam occurs. Based on the type of construction and the condition of the dam, it is judged that the dam could not withstand the depth and duration of overtopping that would occur for the 1/2 PMF. Failure of the dam would cause an increased hazard for loss of life downstream. The spillway is rated as seriously inadequate. According to criteria established for these studies, the dam is rated as unsafe, non-emergency, because the spillway capacity is seriously inadequate.

(2) The structural integrity of the dam is suspect because of the type and age of the dam, and because there were visible signs of structural deterioration and distress. The extent of the hazard cannot be assessed because of the lack of data concerning the design and construction.

(3) The outlet conduit has deteriorated to the extent that it causes a potential hazard to the dam.

(4) A summary of the features and observed deficiencies is listed below:

Feature and Location	Observed Deficiencies
Embankment:	Brush and trees; inadequate slope protection; irregular top width and elevation; depression on top of dam; fill material missing upstream from timber crib.

Feature and Location	Observed Deficiencies
Timber Crib:	Some logs in poor condition; some single logs displaced; crib collapsed at one location; original wood sheeting for seepage control missing.
Dry Stone Masonry Wall:	Possible bulges; small slides at 3 locations; clear seepage at 10 locations at or near toe; soft and swampy areas at or near toe.
Main Spillway:	Crest elevation varies by 0.6 foot over 26.6 feet; concrete cracked; sidewalls lower than adjacent embankment.
Auxiliary Spillway:	Sidewalls lower than adjacent embankment; no defined outlet channel.
Outlet Works:	Outlet conduit severely deteriorated near downstream end.

b. Adequacy of Information. The information available is such that a preliminary assessment of the condition of the dam can be inferred from the combination of visual inspection, past performance, and computations performed as part of the study.

c. Urgency. The recommendations in Paragraph 7.2 should be implemented immediately.

d. Necessity for Further Investigations. In order to accomplish some of the remedial measures outlined in Paragraph 7.2, further investigations by the Owner will be required.

7.2 Recommendations and Remedial Measures.

a. The following measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Perform additional studies to more accurately ascertain the spillway capacity required for Lynchwood Lake Dam as well as the nature and extent of measures required to provide adequate spillway capacity. The studies should also assess the need for an outlet channel for the existing auxiliary spillway. Take appropriate action as required.

(2) Perform comprehensive investigations and studies as required to assess the structural stability and any potentially hazardous conditions that might exist for the dam and the main spillway. The investigations and studies should address conditions within the dam, foundation, and outlet works. Take appropriate action as required.

(3) Other deficiencies that were noted during the inspection should be considered in formulating plans of remedial action.

(4) Until investigations, studies, and remedial work are completed, the Owner should monitor the condition of the dam and appurtenant structures. Take appropriate action as required should any changes in conditions occur.

All investigations, studies, designs, and supervision of construction should be performed by a professional engineer experienced in the design and construction of dams. Monitoring programs should also be performed or supervised by a professional engineer.

b. In addition, it is recommended that the Owner modify his operational procedures as follows:

(1) Develop a detailed emergency operation and warning system for Lynchwood Lake Dam.

(2) During periods of unusually heavy rains, provide round-the-clock surveillance of Lynchwood Lake Dam.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system procedures.

(4) Institute an inspection program such that the dam is inspected frequently. As presently required by the Commonwealth, the program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the results to determine if remedial measures are necessary.

(5) Institute a maintenance program to properly maintain all features of the dam.

APPENDIX A

CHECKLIST - ENGINEERING DATA

CHECKLIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, AND OPERATION
PHASE I

NAME OF DAM: Lynchwood Lake Dam

NDI ID NO.: PA-00773 DER ID NO.: 45-38

Sheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	See Plate E-1 in Appendix E.
CONSTRUCTION HISTORY	Unknown - constructed prior to 1919.
TYPICAL SECTIONS OF DAM	Exterior lines only - no information concerning interior or foundation.
OUTLETS: Plan Details Constraints Discharge Ratings	None.

ENGINEERING DATA

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	None.
DESIGN REPORTS	None.
GEOLOGY REPORTS	None.
DESIGN COMPUTATIONS: Hydrology and Hydraulics Dam Stability Seepage Studies	Spillway capacity computations for modification proposed in 1927.
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	None.
POSTCONSTRUCTION SURVEYS OF DAM	None.

ENGINEERING DATA

ITEM	REMARKS
BORROW SOURCES	Unknown.
MONITORING SYSTEMS	None.
MODIFICATIONS	Main spillway reconstructed 1920. Auxiliary spillway constructed between 1929 and 1935. Outlet works replaced in 1938.
HIGH POOL RECORDS	None.
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM: Description Reports	None.

ENGINEERING DATA

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	None.
SPILLWAY: Plan Sections Details	None.
OPERATING EQUIPMENT: Plans Details	None.
PREVIOUS INSPECTIONS Dates Deficiencies	1919: Lower 2 steps of spillway partially collapsed; upstream earthfill settled 2 feet; small trees growing on dam. 1921: Crest irregular; earthfill upstream from sheet pile settled 1-1.5 feet; downstream dry wall collapsed at one location; noted that spillway was repaired; some seepage. 1922: Same as 1921. 1926: Same as 1921. 1927: Crest narrow and uneven; swampy at toe; ditch cut across top of dam; sheet piling cut down over 40-foot length; embankment low, sheet piles rotted, and signs of overtopping; wall collapsed along

ENGINEERING DATA

ITEM	REMARKS
PREVIOUS INSPECTIONS CONT'D	1927 Cont'd : 15- foot reach ; generally in poor condition; spillway too small. 1928: Crest uneven; settlement; some leakage; swampy at toe; some work done for construction of auxiliary spillway. 1929: Crest uneven; settlement; seepage; swampy at toe; auxiliary spillway incomplete. 1931: Crest uneven; heavy leak from behind base of right abutment and considerable leakage left of spillway; auxiliary spillway not completed. 1934: Auxiliary spillway complete except for downstream paving; new double plank sheeting between aux. and main spillway; dry wall collapsed at several locations; brush; general seepage. 1935: Crest low and uneven; wave erosion; work on auxiliary spillway in progress; general seepage along toe; dry wall collapsed at some locations. 1938: New fill mounded on crest; downstream wall rough and uneven; slides of downstream wall at two locations; some flowing water; erosion at toe of auxiliary spillway. 1944: Brush and trees on crest and slopes; loose earth on crest; crest low; erosion at toe of auxiliary spillway; seepage and swampy areas at toe. 1966: Good condition.

APPENDIX B

CHECKLIST - VISUAL INSPECTION

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: Lynchwood Lake Dam County: Monroe State: Pennsylvania

NDI ID No.: PA-00773 DER ID No.: 45-38

Type of Dam: Rock filled timber crib Hazard Category: High

Date(s) Inspection: 10/22/79 & 11/15/79 Weather: Clear Temperature: 78°

Inspection performed 10/22/79 ; some additional photographs taken 11/15/79

Pool Elevation at Time of Inspection: 1878.7 msl/Tailwater at Time of Inspection: 1863.9 msl

Inspection Personnel:

A.H. Whitman, Jr. (GFCC) J. Moffatt (Caretaker)

D.B. Ebersole (GFCC) M.L. Miller (Lynch Corp.)

L. Marshall (Owner's Engineer)

D.B. Wilson (GFCC) Recorder

EMBANKMENT

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None apparent.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None visible.	Heavy growth of brush and trees along toe.
SLOUGHING OR EROSION: Embankment Slopes Abutment Slopes	Four small slides in downstream dry masonry face. Timber crib collapsed at one location on upstream face.	See Exhibit B-1 for locations. Downstream dry masonry wall very irregular. Crib timbers on upstream face in fair condition below normal pool and fair to poor above normal pool.
CREST ALIGNMENT: Vertical Horizontal	Crest irregular both vertically and horizontally.	See Plates for profile along top of dam.
RIPRAP FAILURES	None apparent.	Riprap does not extend to top of dam but no apparent wave erosion.

EMBANKMENT

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	Right abutment - low area in natural ground beyond right end of dam. Small hole at top of dam behind right sidewall of auxiliary spillway.	
ANY NOTICEABLE SEEPAGE	Seepage and swampy areas at several locations. Maximum single seepage point approx. 5 gpm. All seepage clear.	See Exhibit B-1 for locations of seepage and swampy areas.
STAFF GAGE AND RECORDER	None.	
DRAINS	None.	

MAIN SPILLWAY

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	Seepage at base of spillway at each side. Seepage clear.	See Exhibit B-1 for locations and magnitudes of seepage. Tailwater level could obscure additional seepage.
JUNCTION OF STRUCTURE WITH: Abutment Embankment Other Features	No visible deficiencies.	
DRAINS	None.	
WATER PASSAGES	None.	
FOUNDATION	Tailwater level prevented inspection of toe.	

MAIN SPILLWAY

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SURFACES: Surface Cracks Spalling	Numerous cracks but no spalling or deterioration of concrete.	
STRUCTURAL CRACKING	None.	
ALIGNMENT: Vertical Horizontal	Normal.	
MONOLITH JOINTS	No joints.	
CONSTRUCTION JOINTS	No joints.	
STAFF GAGE OR RECORDER	None.	

OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
~~CRACKING AND SPALLING OF CONCRETE SURFACES IN~~ OUTLET CONDUIT	36-inch diameter steel conduit; poor condition. Bottom half of conduit has rusted away.	Detailed inspection not possible due to flow of water; estimated that conduit has deteriorated over 10-foot length.
INTAKE STRUCTURE	Timber and concrete structure located at top of dam along upstream face.	No gate - intake controlled by stop logs. Intake structure in good condition.
OUTLET STRUCTURE	None - outlet conduit has free overfall.	No apparent erosion from free overfall.
OUTLET CHANNEL	Conduit discharges into outlet channel of main spillway.	No apparent deficiencies.
EMERGENCY GATE	None - stop log control.	Stop logs placed above main spillway crest level would stop conduit flow.

(AUXILIARY SPILLWAY)
UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Concrete lining on downstream slope of embankment.	Lining has random cracks but no apparent structural deficiencies.
APPROACH CHANNEL	Reservoir area. Upstream slope protected by riprap but crest is not. Has wooden sheeting cutoff at upstream side of lining.	Diving platform in approach area. Not a serious obstruction.
DISCHARGE CHANNEL	Not a defined channel. Flow would go into wooded area with a wide swale.	
BRIDGE AND PIERS	None.	

INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	

DOWNSTREAM CHANNEL

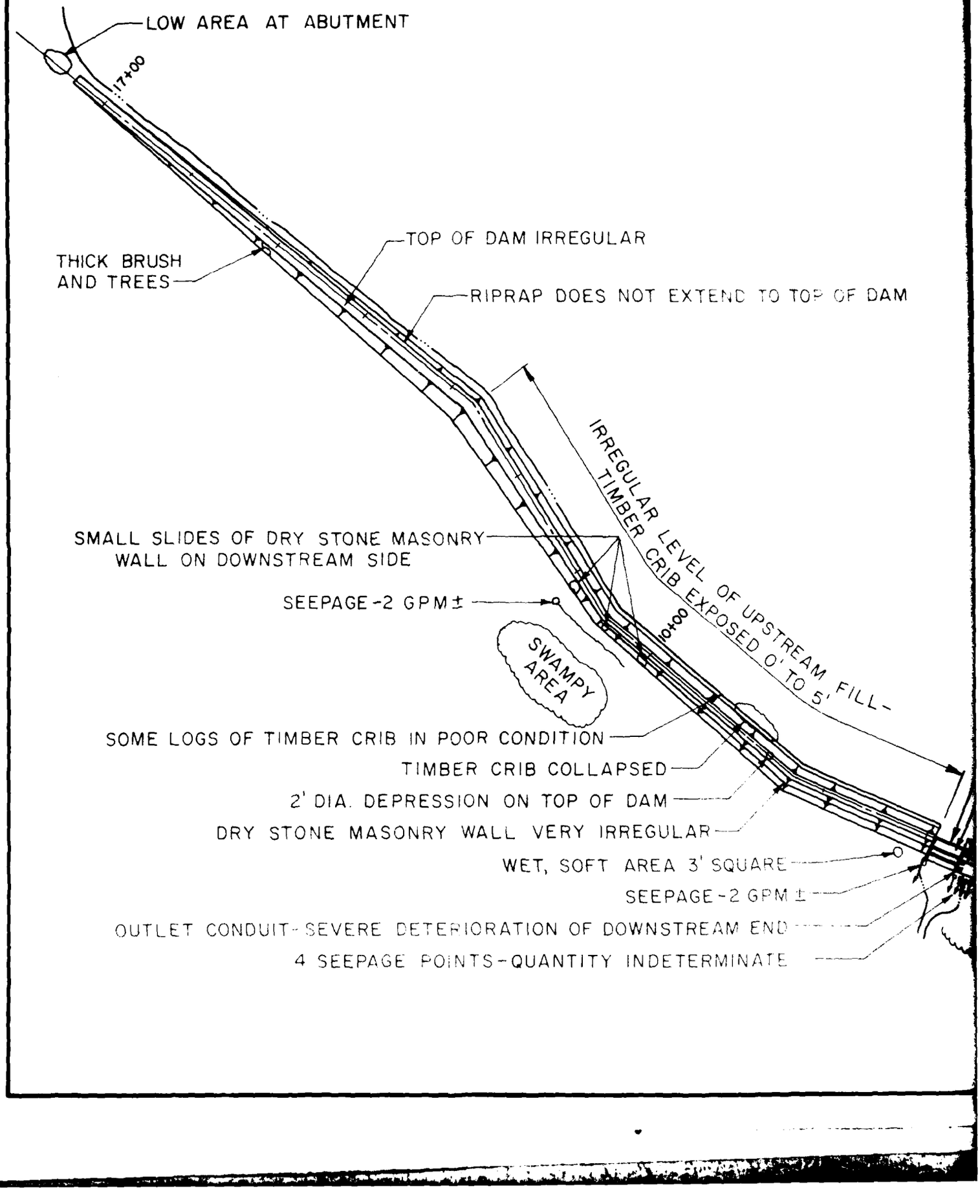
Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: Obstructions Debris Other	Relatively straight. Wooded and thick brush. Hawkey Pond 1400' downstream. R.R. embankment 2000' downstream	Railroad embankment 22' high. Horseshoe conduit 14' wide x 13.8' high.
SLOPES	Mild, wooded with thick brush.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Approx. 8 low-lying houses located between R.R. embankment and Stillwater Lake.	Houses are part of a real estate development.

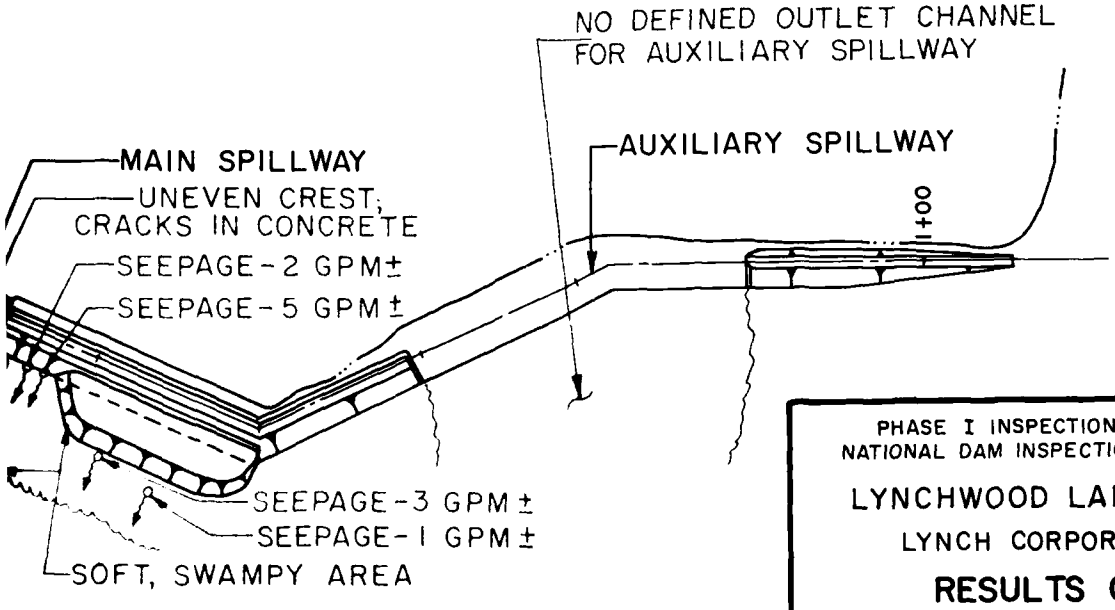
RESERVOIR AND WATERSHED

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Mild - no problems with slope stability.	
SEDIMENTATION	No reported problem.	
WATERSHED DESCRIPTION	Nearly all wooded; substantial residential development; numerous swampy areas.	


LOW AREA AT ABUTMENT
17+00
THICK BRUSH AND TREES
TOP OF DAM IRREGULAR
RIPRAP DOES NOT EXTEND TO TOP OF DAM
IRREGULAR LEVEL OF UPSTREAM FILL - TIMBER CRIB EXPOSED 0' TO 5'
SMALL SLIDES OF DRY STONE MASONRY WALL ON DOWNSTREAM SIDE
SEEPAGE - 2 GPM ±
SWAMPY AREA
SOME LOGS OF TIMBER CRIB IN POOR CONDITION
TIMBER CRIB COLLAPSED
2' DIA. DEPRESSION ON TOP OF DAM
DRY STONE MASONRY WALL VERY IRREGULAR
WET, SOFT AREA 3' SQUARE
SEEPAGE - 2 GPM ±
OUTLET CONDUIT - SEVERE DETERIORATION OF DOWNSTREAM END
4 SEEPAGE POINTS - QUANTITY INDETERMINATE

NOTE:
ALL OBSERVED SEEPAGE WAS CLEAR.



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

LYNCHWOOD LAKE DAM
LYNCH CORPORATION

RESULTS OF VISUAL INSPECTION

JANUARY 1980 EXHIBIT B-1

APPENDIX C

PHOTOGRAPHS

A. Upstream Slope Near Left Abutment

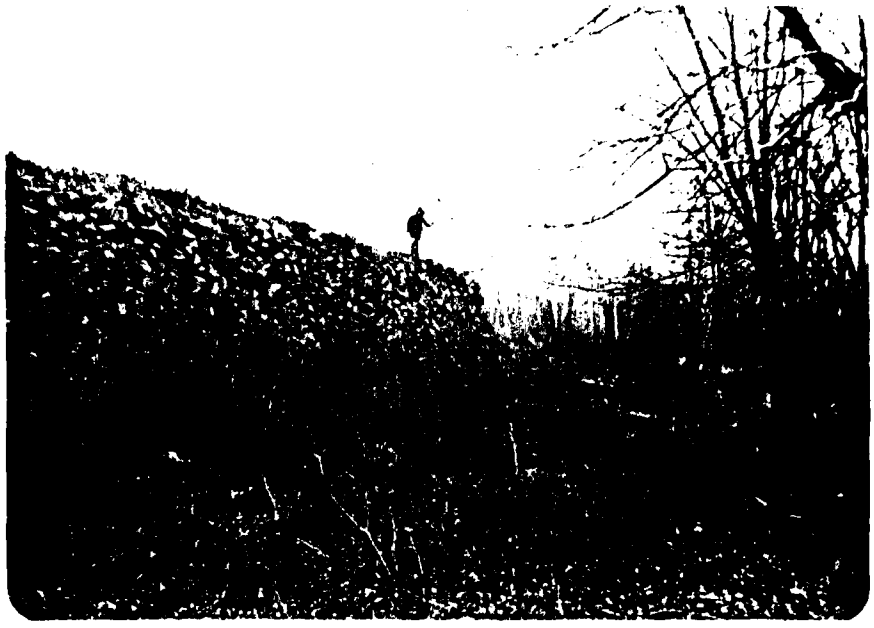
B. Upstream Slope - Exposed Timber Crib

C. Upstream Slope - Exposed Timber Crib

D. Upstream Slope - Bulge in Timber Crib

E. Low Area at Right Abutment

F. Top of Dam

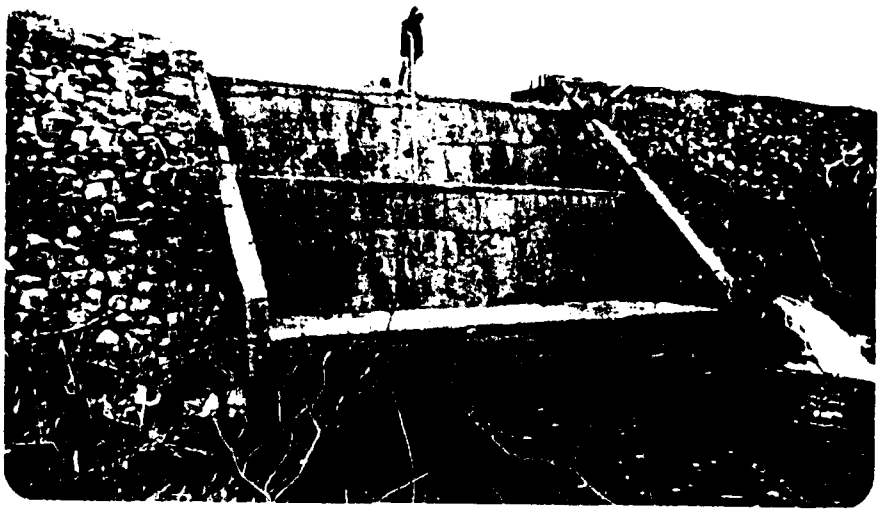


G. Dry Stone Masonry Wall

H. Small Slide in Dry Stone Masonry Wall

I. Small Slide in Dry Stone Masonry Wall

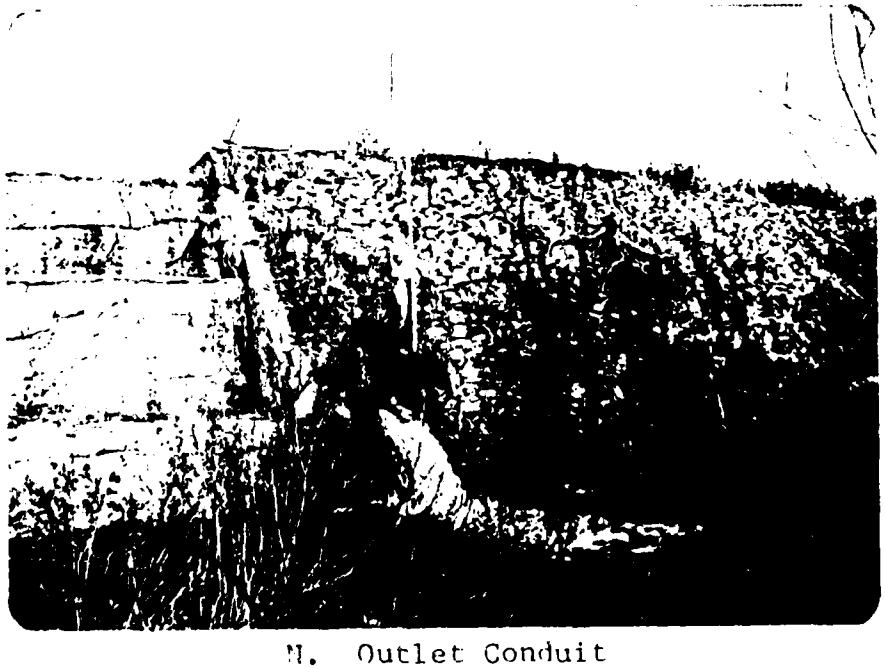
J. Dry Stone Masonry Wall near Main Spillway



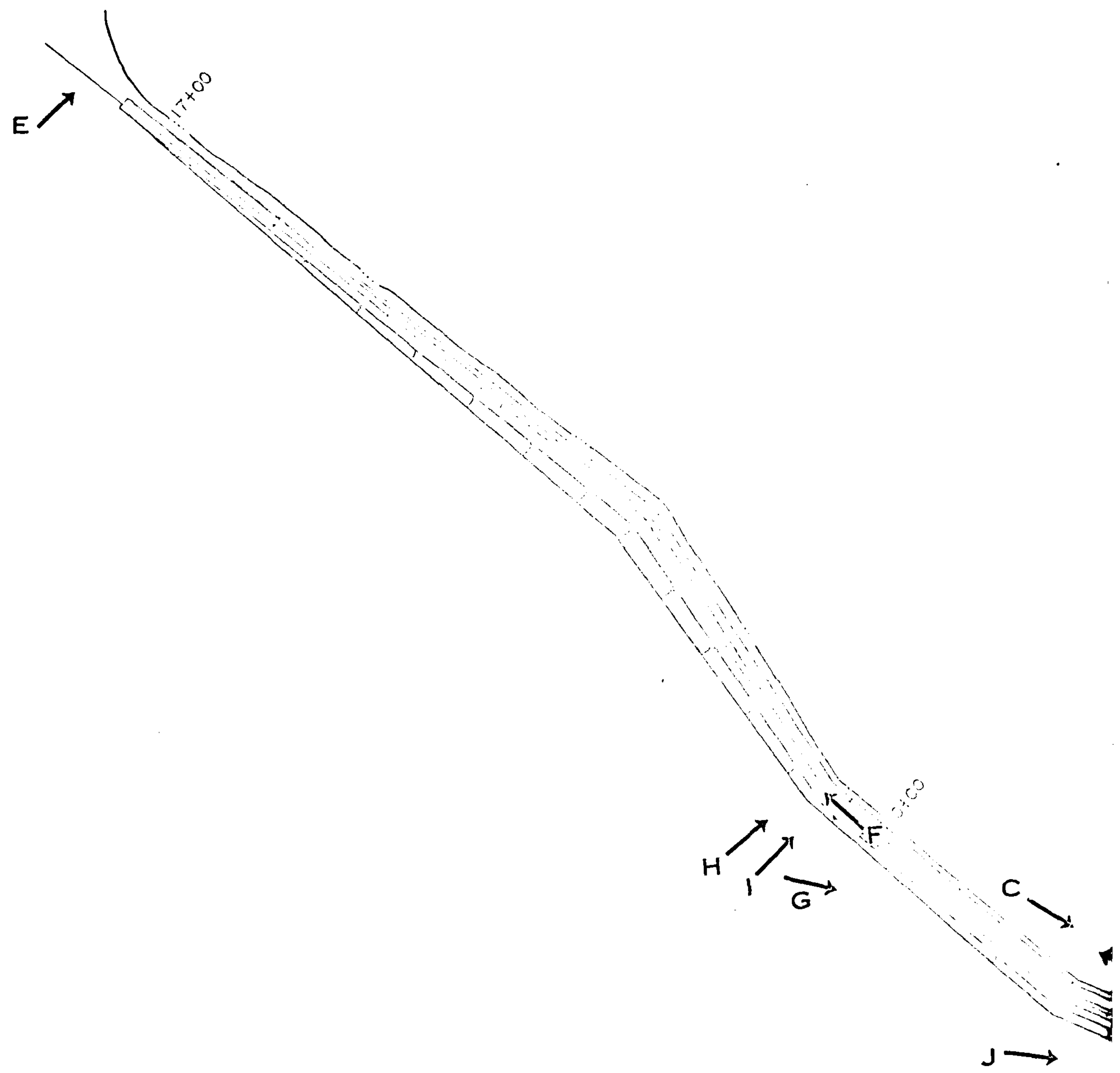
K. Main Spillway

L. Auxiliary Spillway

M. Main Spillway Crest and Outlet Works Intake Structure



N. Outlet Conduit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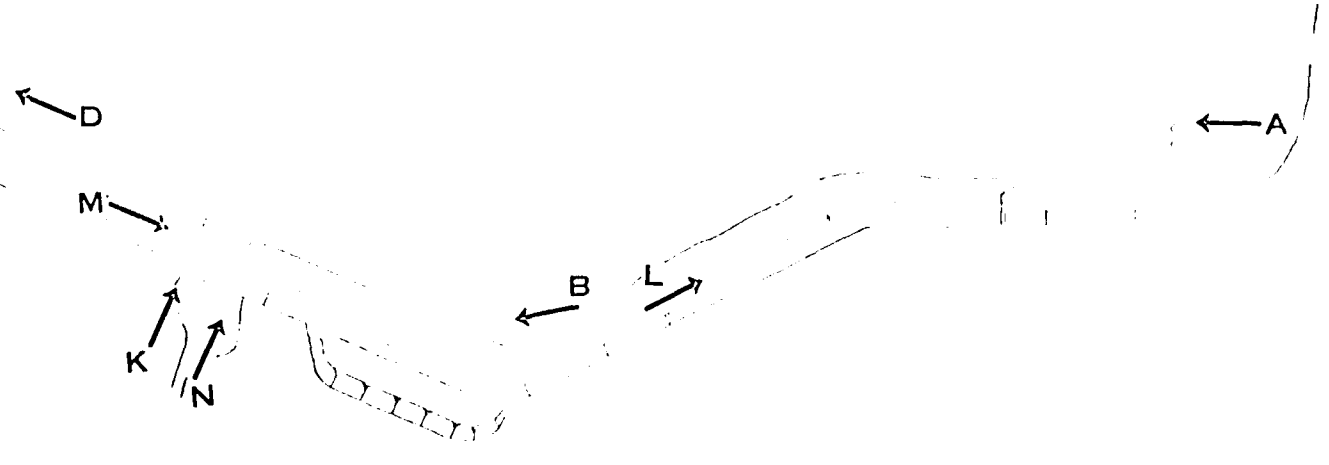


← LOCATION AND ORIENTATION OF CAMERA

A PHOTOGRAPH IDENTIFICATION LETTER

[illegible]

[illegible]HWOOD LAKE DAM
[illegible]NCE COUNTY

DE TO LOCATION
PHOTOGRAPHS

1980 EXHIBIT C-1

APPENDIX D

HYDROLOGY AND HYDRAULICS

APPENDIX D

HYDROLOGY AND HYDRAULICS

Spillway Capacity Rating:

In the recommended Guidelines for Safety Inspection of Dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended Spillway Design Flood (SDF) for the size (small, intermediate, or large) and hazard potential (low, significant, or high) classification of a dam is selected in accordance with the criteria. The SDF for those dams in the high hazard category varies between one-half of the Probable Maximum Flood (PMF) and the PMF. If the dam and spillway are not capable of passing the SDF without overtopping failure, the spillway capacity is rated as inadequate. If the dam and spillway are capable of passing one-half of the PMF without overtopping failure, or if the dam is not in the high hazard category, the spillway capacity is not rated as seriously inadequate. A spillway capacity is rated as seriously inadequate if all of the following conditions exist:

(a) There is a high hazard to loss of life from large flows downstream of the dam.

(b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.

(c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

Description of Model:

If the Owner has not developed a PMF for the dam, the watershed is modeled with the HEC-1DB computer program, which was developed by the U.S. Army Corps of Engineers. The HEC-1DB computer program calculates a PMF runoff hydrograph (and percentages thereof) and routes the flows through both reservoirs and stream sections. In addition, it has the capability to simulate an overtopping dam failure. By modifying the rainfall criteria, it is also possible to model the 100-year flood with the program.

APPENDIX D

Delaware River Basin

Name of Stream: Clear Run

Name of Dam: Lynchwood Lake Dam

NDI ID No.: PA-00773

DER ID No.: 45-38

Latitude: N 41° 08' 45" Longitude: W 75° 23' 25"

Top of Dam Elevation: 1882.7

Streambed Elevation: 1862.9 Height of Dam: 19.8 ft

Reservoir Storage at Top of Dam Elevation: 365 acre-ft

Size Category: Small

Hazard Category: High (see Section 5)

Spillway Design Flood: Varies from 1/2 PMF to PMF
Select PMF based on downstream conditions

UPSTREAM DAMS

Name	Distance from Dam (miles)	Height (ft)	Storage at top of Dam Elevation (acre-ft)	Remarks
	No Upstream Dams			

DOWNSTREAM DAMS

Stillwater	2.8	8	2,150	
Lake Naomi	5.5	6	1,790	Phase I Inspection July 1979

Delaware River Basin

Name of Stream: Clear Run

Name of Dam: Lynchwood Lake Dam

DETERMINATION OF PMF RAINFALL & UNIT HYDROGRAPH

UNIT HYDROGRAPH DATA:

Sub-area	Drainage Area (square miles)	Cp (1)	Ct (2)	L miles (3)	L_{ca} miles (4)	L' miles (5)	Tp hours (6)	Map Area (7)	Plate (8)
A-1	3.40	0.45	2.10	2.50	0.91	N/A	2.7	2	B
Total	3.40								

(See Sketch on Sheet D-4)

(1) & (2): Snyder Unit Hydrograph coefficients supplied by Baltimore District, Corps of Engineers on maps and plates referenced in (7) & (8)

The following are measured from the outlet of the subarea:

(3): Length of main watercourse extended to divide

(4): Length of main watercourse to the centroid

The following is measured from the upstream end of the reservoir at normal pool:

(5): Length of main watercourse extended to divide

(6): $Tp=C_t \times (L \times L_{ca})^{0.3}$, except where the centroid of the subarea is located in the reservoir. Then $Tp=C_t \times (L')^{0.6}$

Initial flow is assumed at 1.5 cfs/sq. mile

Computer Data: QRCSN = -0.05 (5% of peak flow)

RTIOR = 2.0

RAINFALL DATA:

PMF Rainfall Index= 22.3 in., 24 hr., 200 sq. mile.

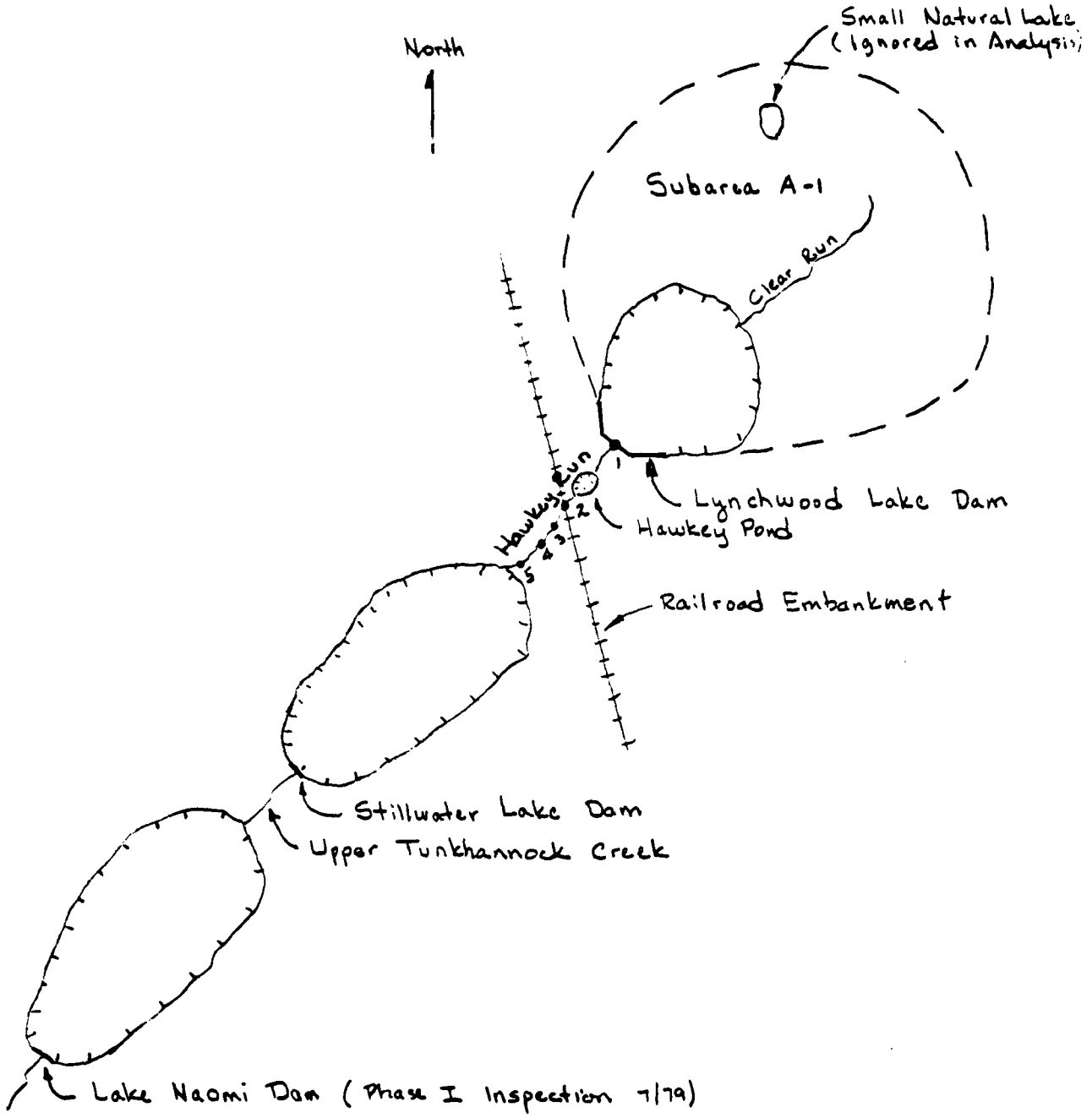
	Hydromet. 40 (Susquehanna Basin)	Hydromet. 33 (Other Basins)
Zone:	N/A	1
Geographic Adjustment Factor:	N/A	1.0
Revised Index Rainfall:	N/A	22.3

RAINFALL DISTRIBUTION (percent)

Time	Percent
6 hours	111
12 hours	123
24 hours	131
48 hours	142
72 hours	—
96 hours	—

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT Lynchwood Lake Dam FILE NO.
SHEET NO. OF SHEETS
FOR National Dam Inspection Program
COMPUTED BY DATE CHECKED BY DATE



Lynchwood Lake Dam

D-4

Sketch of System
NOT TO SCALE

8219

Data for Dam at Outlet of Subarea A-1 (see Sketch on Sheet D-4)

Name of Dam: Lynchwood Lake Dam

SPILLWAY DATA:	Existing Conditions	Design Conditions
Top of Dam Elevation	1882.7	N/A
Spillway Crest Elevation	1880.7	
Spillway Head Available (ft)	2.0	
Type Spillway	Broad-crested weir	
"C" Value - Spillway	2.7	
Crest Length - Spillway (ft)	25.2	
Spillway Peak Discharge (cfs)	192	
Auxiliary Spillway Crest Elev.	1881.8	
Auxiliary Spill. Head Avail. (ft)	0.9	
Type Auxiliary Spillway	Paved embankment section	
"C" Value - Auxiliary Spill. (ft)	3.1	
Crest Length - Auxil. Spill. (ft)	205.6	
Auxiliary Spillway Peak Discharge (cfs)	544	
Combined Spillway Discharge (cfs)	736	N/A

Spillway Rating Curve:

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)
1880.7	0	0	0
1881.0	11	0	11
1881.8	78	0	78
1882.0	101	57	158
1882.7	192	544	736
1883.2	269	1056	1325
1885.0	607	3648	4255
1890.0	1930	14966	16896

OUTLET WORKS RATING:	Outlet 1	Outlet 2	Outlet 3
Invert of Outlet	1866.7		
Invert of Inlet	1867.0 (Assumed)		
Type	Steel		
Diameter (ft) = D	3		
Length (ft) = L	35		
Area (sq. ft) = A	7.1		
N	0.016		
K Entrance	0.5		
K Exit	1.0		
K Friction=$29.1_N{}^2L/R^{4/3}$	0.3		
Sum of K	1.8		
$(1/K)^{0.5}$ = C	0.75		
Maximum Head (ft) = HM	15.7		
$Q = CA\sqrt{2g(HM)}$(cfs)	169		
Q Combined (cfs)	169		

Data for Dam at Outlet of Subarea A-1 (See sketch on Sheet D-4)

Name of Dam: Lynchwood Lake Dam

STORAGE DATA:

Elevation		Area (acres)		Storage million gals	acre-ft		Remarks
1861.3	=ELEVO*	0		0	0		
1880.7	=ELEV1	44	=A1	93	285	=S1	Record Data
1882.7		51		124	380		Low Area
1900.0		138		638	1957		

* ELEVO = ELEV1 - $(3S_1/A_1)$

** Planimetered contour at least 10 feet above top of dam

Reservoir Area at Normal Pool is 2 percent of subarea watershed.

BREACH DATA: See Next Sheet

~~See Appendix B for sections and existing profile of the dam.~~

~~Soil Type from Visual Inspection:~~ _____

~~Maximum Permissible Velocity (Plate 28, EM 1110-2-1601)~~ _____ ~~fps~~
(~~from Q = CLH$^{3/2}$ - V·A and depth = (2/3) x H) & A = L·depth~~

~~HMAX = (4/9 V^2/G^2) =~~ _____ ~~ft., G =~~ _____ ~~Top of Dam El.=~~ _____

~~HMAX + Top of Dam El. =~~ _____ ~~= FAILEL~~
(~~Above is elevation at which failure would start~~)

Dam Breach Data:

BRWID = 100 ft (width of bottom of breach)
Z = 1V on 1H (side slopes of breach)
ELBM = 1867.2 (bottom of breach elevation, minimum of zero storage elevation)
WSEL = 1880.7 (normal pool elevation)
T FAIL= 6 mins = 0.1 hrs (time for breach to develop)

Breach Data :

The low area (El. 1882.7) is located beyond the end of the dam at the right abutment, and damage and/or failure might result from flow along the toe rather than due to overtopping. In attempt to account for this possibility, the breach data was developed in a different manner. Uncontrolled flow begins at pool elevation 1882.7. It was assumed that failure began at Elevation 1883.2, which is the pool level at which general overtopping of the dam itself begins. Such assumptions appear to provide a reasonable balance between the two modes of possible failure. Breach width (BRWID) was determined from the profile of the top of the dam between Stations 9+00 and 10+00, which is essentially at the failure elevation (FAILEL) of Elevation 1883.2.

Procedure for Evaluating Downstream Effects of Failure:

A. General: Visual inspection indicated that the railroad embankment located downstream could have significant effects in the event of failure of Lynchwood Dam. Because of the height (22 feet) and the width (50 feet) of the embankment, it was included in the analysis (it was assumed not to fail as a result of failure of Lynchwood Lake Dam).

B. Outline of Procedure:

1. Model failure of Lynchwood Lake Dam using Breach Data on Sheets D-6 and D-7.

2. Treat railroad embankment as a dam (stage-discharge curve to be determined for horseshoe conduit through embankment). No routing of failure hydrograph is necessary between the dam and the railroad embankment due to short distance (0.4 mile)

3. Route outflow from railroad culvert downstream through damage reach to Stillwater Lake Dam.

4. No routing necessary through Stillwater Lake because available surcharge storage is sufficient to contain all water from Lynchwood provided there is no intervening flow. Computations shown below:

Lynchwood Lake Storage at Top of Dam = 380 acre-ft.

Available Head at Stillwater Dam = 1.5 feet (from Phase I Report for Lake Naomi Dam, which included analysis of Stillwater Dam)

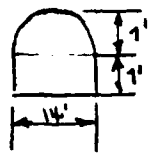
Normal Surface Area Stillwater Lake = 329 acres (planimetered)

Minimum available surcharge storage = (1.5)(329) = 493.5 A-F

Since 493.5 > 380, failure of Lynchwood would not by itself cause overtopping of Stillwater

Rating Curve for R.R Embankment Horseshoe Conduit :

1. Assume critical depth control at end of conduit. (visual inspection indicated that tailwater control is unlikely).
2. Neglect losses at entrance and in conduit.
3. Conduit dimensions:



175 ft²

Conduit Rating Curve

Approximate invert elevation = El. 1832 (USGS Contours)

y_c	A	Q*	Y	$V^2/2g$	Pool El.**
0	—	—	—	—	1832.0
1	14.0 ft²	79 cfs	5.67	0.5 ft.	1833.5
3	42.0	413	9.83	1.5	1836.5
5	70.0	888	12.69	2.5	1839.5
7	98.0	1471	15.01	3.5	1842.5
9	125.6	2180	17.36	4.7	1845.7
11	150.8	3100	20.56	6.6	1841.6
12	161.5	3720	23.03	8.2	1852.2

USING $Q = 0.7 \times 175 \times \sqrt{2g(\text{Pool} - 1839)}$ [ORIFICE EQUATION]

3810	1854.0
4500	1860.0

* $Q = \left(g A^3/T\right)^{1/2}$

** Pool El. = Elevation of water surface on upstream side of R.R. embankment.

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SUBJECT Lynchwood Lake Dam FILE NO.
SHEET NO. OF SHEETS
FOR National Dam Inspection Program
COMPUTED BY DATE CHECKED BY DATE

Storage Data for R.R. Embankment

Elevation	Area (acres)	Storage		Remarks
		million gals	acre-ft	
1832.0	0	0	0	Conduit invert
1840.0	5		13.3	
1854.0	21.4		185.0	Top of embankment
1860.0	32		344.3	

Note: Existing pool of Hawkey Pond was ignored in analysis as having only minor effect on results.

6313

Selected Computer Output

FLOOD HYDROGRAPH PACKAGE (HEC-1)

DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79

```
    1                A1                                NATIONAL DAM INSPECTION PROGRAM
    2                A2                                          CLEAR RUN
    3                A3                                  LYNCHWOOD LAKE DAM
    4                B     300       0       15        0        0        0        0        0       -4        0
    5                B1      5
    6                J       1       9        1
    7                J1    1.0      .50      .35      .30      .25      .20      .15      .10      .05
    8                K       0       1                          0        0        1
    9                K1        RUNOFF INTO LYNCHWOOD LAKE
   10                M       1       1      3.4                 0        0                          1
   11                P       8    22.3      111      123      131      142
   12                T                                                          1.0      .05               .02
   13                W     2.7     0.45
   14                X    -1.5    -0.05      2.0
   15                K       1       1                          0        0        1
   16                K1        ROUTE THROUGH LYNCHWOOD LAKE
   17                Y                                  1        0
   18                Y1      1                                                -1880.7     -1
   19                Y41880.7  1881.0  1881.8  1882.0  1882.7  1883.2  1885.0  1890.0
   20                Y5      0      11      78     158     736    1325    4255   16896
   21                $A      0      44      51     138
   22                $E1861.7  1880.7  1882.7  1900.0
   23                $S1880.7
   24                $D1882.7
   25                $L      1      90     120     464     937    1410
   26                $V1882.7  1883.0  1883.2  1883.5  1884.0  1885.0
   27                K      99
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS								
				RATIO 1 1.00	RATIO 2 .50	RATIO 3 .35	RATIO 4 .30	RATIO 5 .25	RATIO 6 .20	RATIO 7 .15	RATIO 8 .10	RATIO 9 .05
HYDROGRAPH AT	1	3.40	1	5739.	2869.	2009.	1722.	1435.	1148.	861.	574.	287.
	(	8.81)	(	162.50)(	81.25)(	56.88)(	48.75)(	40.63)(	32.50)(	24.38)(	16.25)(	8.13)
ROUTED TO	1	3.40	1	5729.	2855.	1990.	1700.	1603.	1115.	827.	541.	247.
	(	8.81)	(	162.22)(	80.79)(	56.36)(	48.14)(	39.74)(	31.58)(	23.41)(	15.33)(	6.98)

D-13

SUMMARY OF DAM SAFETY ANALYSIS

LYNCHWOOD LAKE DAM

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1880.70	1880.70	1882.70
STORAGE	285.	285.	379.
OUTFLOW	0.	0.	736.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1884.37	1.67	470.	5729.	15.25	42.50	0.00
.50	1883.76	1.06	436.	2853.	11.00	42.75	0.00
.35	1883.48	.78	420.	1990.	8.50	42.75	0.00
.30	1883.35	.65	414.	1700.	7.50	42.75	0.00
.25	1883.21	.51	406.	1403.	6.25	43.00	0.00
.20	1883.01	.31	395.	1115.	4.50	43.00	0.00
.15	1882.78	.08	383.	827.	2.25	43.25	0.00
.10	1882.46	0.00	368.	541.	0.00	43.25	0.00
.05	1882.11	0.00	350.	247.	0.00	44.00	0.00

D-14

```
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
```

```
    1                A1                                NATIONAL DAM INSPECTION PROGRAM
    2                A2                                        CLEAR RUN
    3                A3                                LYNCHWOOD LAKE DAM
    4                B     300         0         6         0         0         0         0         0        -4         0
    5                B1      5
    6                J       2         1         1
    7                J1    0.5
    8                K       0         1                             0         0         1
    9                K1        RUNOFF INTO LYNCHWOOD LAKE
   10                M       1         1       3.4                   0         0                             1
   11                P       0      22.3       111       123       131
   12                T                                                                 1.0       .05                  .02
   13                W     2.7       0.45
   14                X    -1.5      -0.05       2.0
   15                K       1         1                             0         0         1
   16                K1        ROUTE THROUGH LYNCHWOOD LAKE
   17                Y                                       1         1
   18                Y1      1                                                       -1880.7        -1
   19                Y4 1880.7    1881.0    1881.8    1882.0    1882.7    1883.2    1885.0    1890.0
   20                Y5      0        11        78       158       736      1325      4255     16896
   21                SA      0        44        51       138
   22                SE 1861.3    1880.7    1882.7    1900.0
   23                SS 1880.7
   24                SD 1882.7
   25                SL      1        90       120       464       937      1410
   26                SV 1882.7    1883.0    1883.2    1883.5    1884.0    1885.0
   27                SB    100         1    1867.2        .1    1880.7    1890.0
   28                SB    100         1    1867.2        .1    1880.7    1883.2
   29                K       1         2                                                 1
   30                K1        ROUTE THROUGH RAILROAD CULVERT
   31                Y                                       1         1
   32                Y1      1                                                       -1832.0        -1
   33                Y4   1832    1833.5    1836.5    1839.5    1842.5    1845.7    1849.6    1852.2      1854      1860
   34                Y5      0        79       413       888      1471      2180      3100      3720      3810      4500
   35                SA      0         5      21.4        32
   36                SE   1832      1840      1854      1860
   37                SS   1832
   38                SD   1854
   39                SL      1       400
   40                SV   1854      1860
   41                K       1         3                                                 1
   42                K1        STREAM X-SECT
   43                Y                                       1         1
   44                Y1      1                                                          -1
   45                Y6     .1       .07        .1      1826      1846       500    .0103
   46                Y7      0      1865       850      1840      1000      1529      1001      1826      1016      1826
   47                Y7   1017      1829      1650      1940      2475      1960
   48                K       1         4                                                 1
   49                K1        STREAM X-SECT
   50                Y                                       1         1
```

```
51          Y1     1                                                    -1
52          Y6    .1      .07      .1    1816    1840    2600   .0019
53          Y7     0    1840      300    1820    1850    1820    1851    1816    1866    1816
54          Y7  1867    1820     2000    1820    4050    1840
55          K      1       5                                           1
56          K1        STREAM X-SECT
57          Y                                    1       1
58          Y1     1                                                    -1
59          Y6    .1      .07      .1    1811    1820    3000   .0019
60          Y7     0    1820     2000    1814    2200    1814    2201    1811    2216    1811
61          Y7  2217    1814     4000    1820    5100    1840
62          K     99
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .50
HYDROGRAPH AT	1	3.40	1	2836.
	(	8.81)	(	80.31)(
			2	2836.
			(	80.31)(
ROUTED TO	1	3.40	1	2820.
	(	8.81)	(	79.85)(
			2	19733.
			(	558.78)(
ROUTED TO	2	3.40	1	2721.
	(	8.81)	(	77.05)(
			2	6346.
			(	179.69)(
ROUTED TO	3	3.40	1	2721.
	(	8.81)	(	77.05)(
			2	6212.
			(	175.90)(
ROUTED TO	4	3.40	1	2667.
	(	8.81)	(	75.53)(
			2	3954.
			(	111.98)(
ROUTED TO	5	3.40	1	2549.
	(	8.81)	(	72.19)(
			2	3434.
			(	97.23)(

SUMMARY OF DAM SAFETY ANALYSIS

LYNCHWOOD LAKE DAM

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1880.70	1880.70	1882.70
STORAGE	285.	285.	379.
OUTFLOW	0.	0.	736.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1883.75	1.05	435.	2820.	9.80	18.50	0.00

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1880.70	1880.70	1882.70
STORAGE	285.	285.	379.
OUTFLOW	0.	0.	736.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1883.20	.50	406.	19733.	1.17	16.50	16.40

SUMMARY OF DAM SAFETY ANALYSIS

RAILROAD EMBANKMENT

PLAN 1 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1832.00	1832.00	1854.00
STORAGE	0.	0.	195.
OUTFLOW	0.	0.	3810.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1847.99	0.00	83.	2721.	0.00	19.20	0.00

PLAN 2 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1832.00	1832.00	1854.00
STORAGE	0.	0.	195.
OUTFLOW	0.	0.	3810.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1857.75	3.75	277.	6346.	1.00	16.80	0.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	2721.	1833.5	19.30

PLAN 2 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	6212.	1835.5	16.90

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	2667.	1821.5	19.80

PLAN 2 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	3954.	1822.0	17.40

PLAN 1 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	2549.	1816.7	20.70

PLAN 2 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	3434.	1817.0	18.70

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
SHEET NO. ____ OF ____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

Lynchwood Lake Dam
Summary of Pertinent Results

PMF Rainfall = 25.33 inches

Multi-ratio Analysis

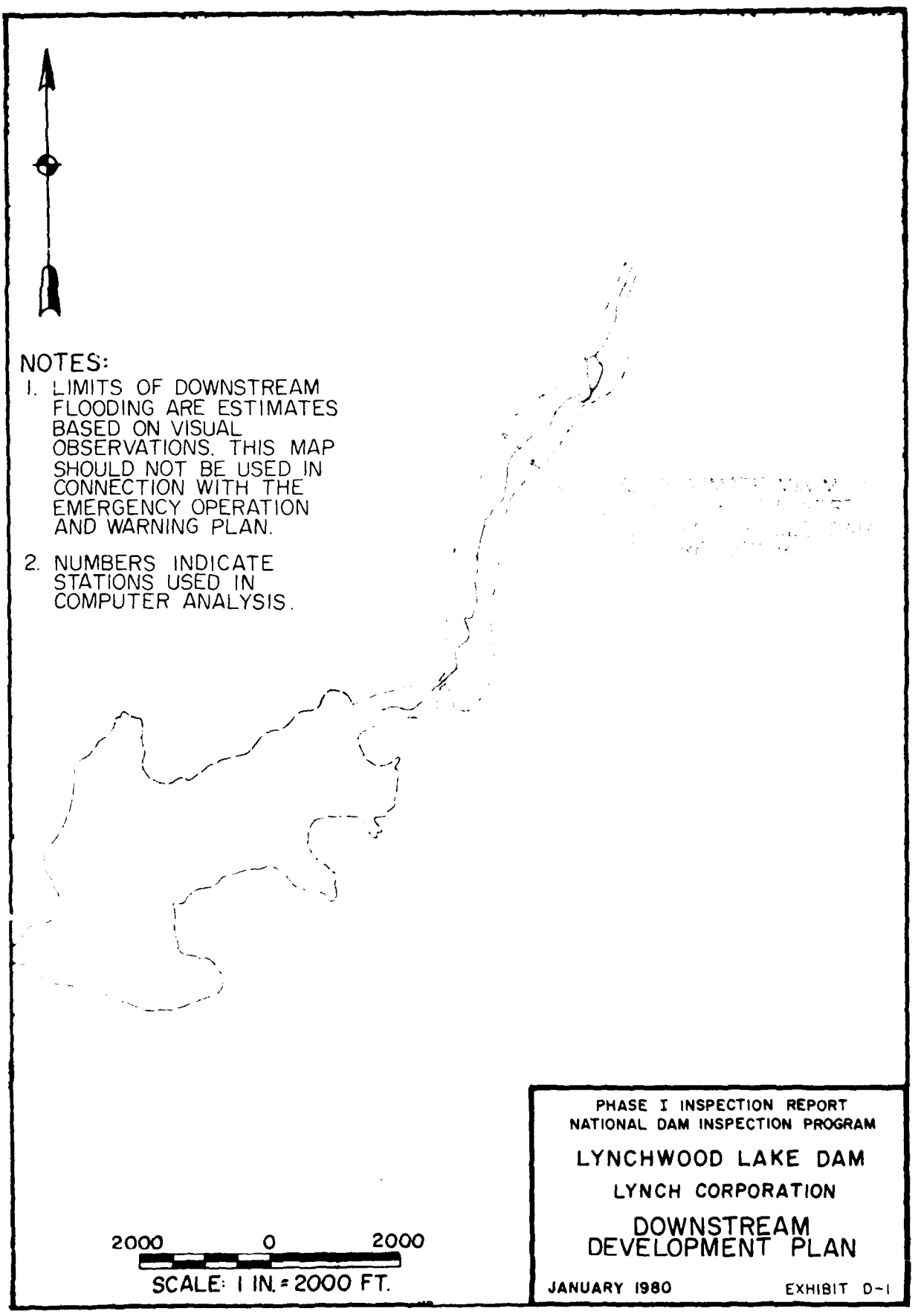
Lynchwood Lake Dam :	PMF	½ PMF
Runoff (inches)	22.98	11.49
Inflow (cfs)	5,739	2,869
Outflow (cfs)	5,729	2,853
Depth of Overtopping (ft)	1.67	1.06
Duration of Overtopping (hr)	15.25	11.00

Breach Analysis (½ PMF)

Station Number	Stream Depth (ft) No Failure	Failure	Δ Depth (ft)
3	7.5	9.5	2.0
4	5.5	6.0	0.5
5	5.7	6.0	0.3

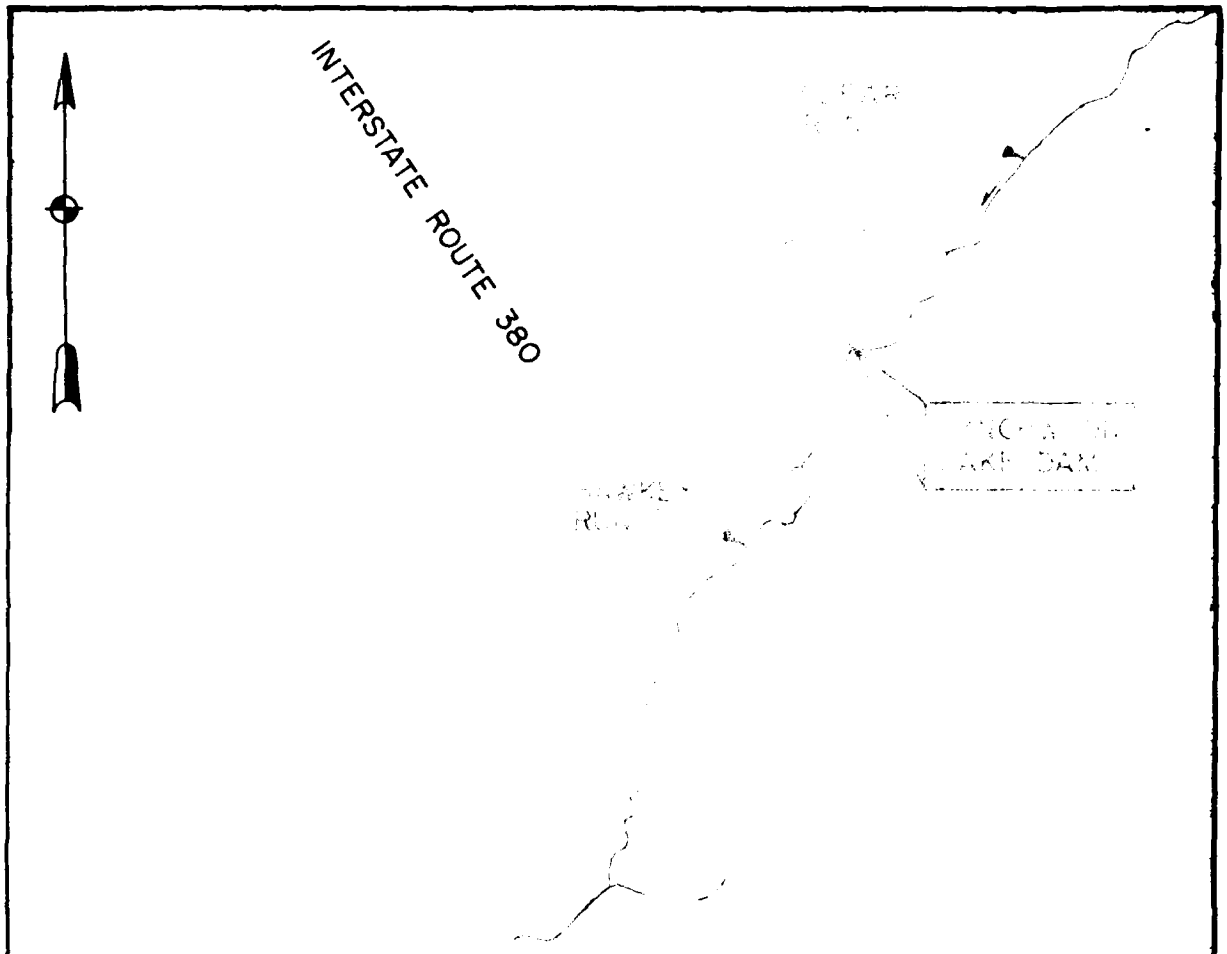
Notes:

1. Depth of overtopping at Lynchwood Lake Dam measured from low area at right abutment.
2. Breach analysis assumed that railroad embankment did not fail even though overtopped by 3.75 feet. If railroad embankment failed, depth increases would be significantly greater.
3. Station Number Identification:
   - Station 3 - 2 Dwellings at Station
   - Station 4 - 6 Dwellings at Station
   - Station 5 - 5 Dwellings at Station


NOTES:
1. LIMITS OF DOWNSTREAM FLOODING ARE ESTIMATES BASED ON VISUAL OBSERVATIONS. THIS MAP SHOULD NOT BE USED IN CONNECTION WITH THE EMERGENCY OPERATION AND WARNING PLAN.
2. NUMBERS INDICATE STATIONS USED IN COMPUTER ANALYSIS.
2000 0 2000
SCALE: 1 IN. = 2000 FT.
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
LYNCHWOOD LAKE DAM
LYNCH CORPORATION
DOWNSTREAM DEVELOPMENT PLAN
JANUARY 1980
EXHIBIT D-1

APPENDIX E

PLATES



2000 0 2000

SCALE: 1 IN. = 2000 FT.

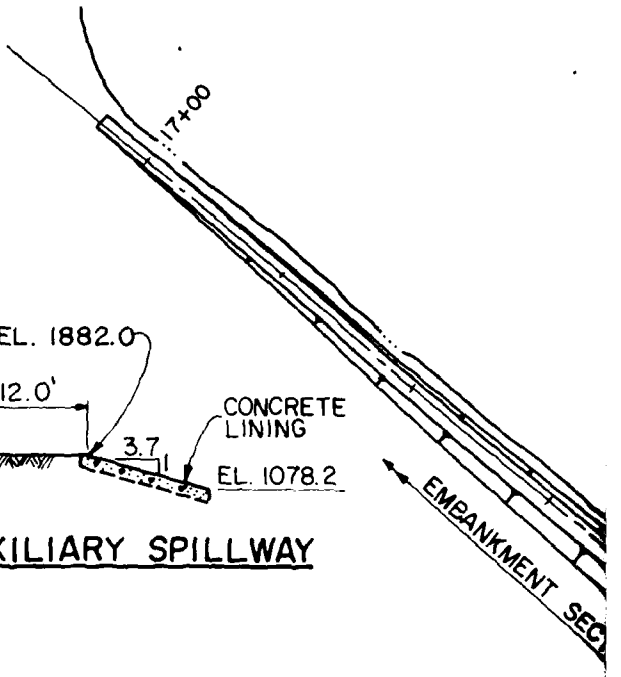
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

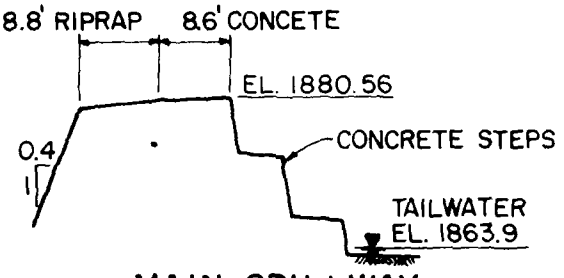
LYNCHWOOD LAKE DAM

LYNCH CORPORATION

LOCATION MAP

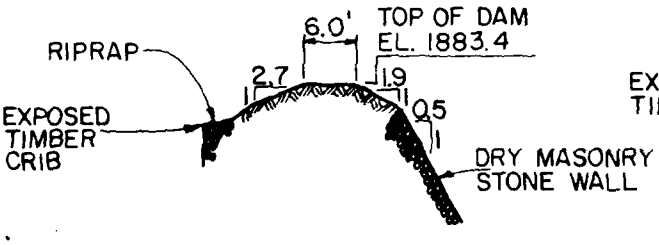
JANUARY 1980 PLATE E-1



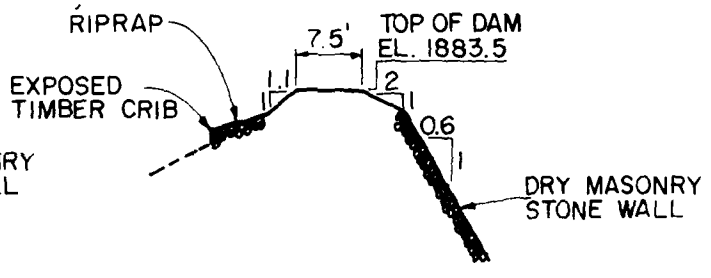


MAIN SPILLWAY

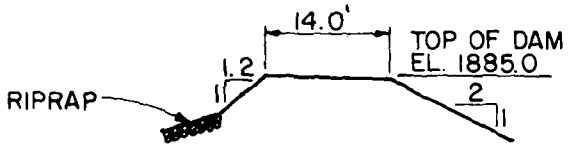
AUXILIARY SPILLWAY



STATION 8+00



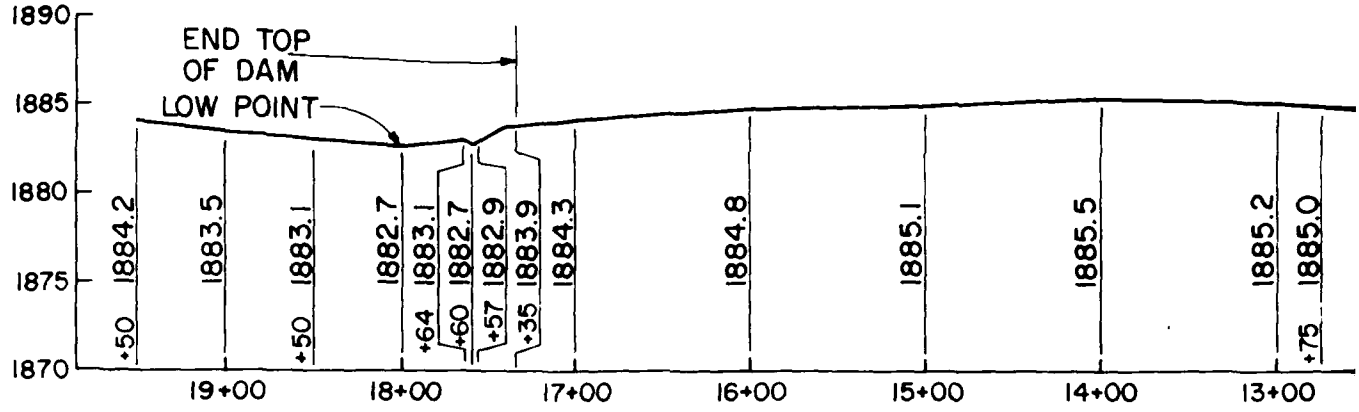
STATION 6+50

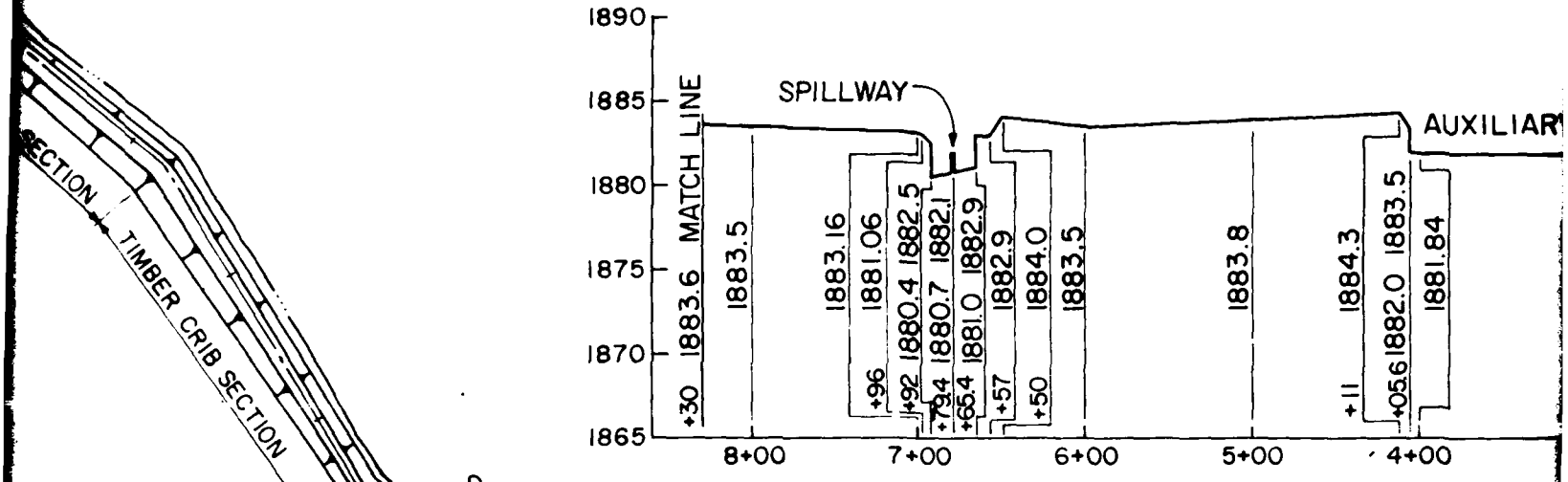


STATION 12+75

SECTIONS

SCALE: 1 IN. = 10 FT.





PROFILE-TOP OF DA

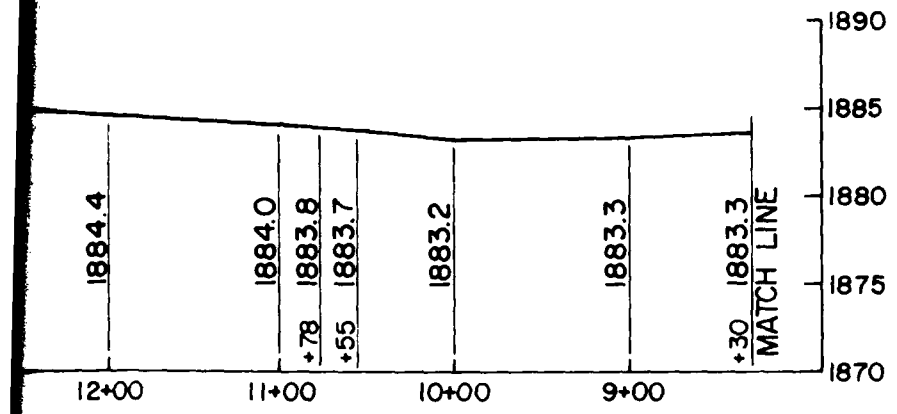
HORIZ. SCALE: 1 IN. = 100 FT. VE

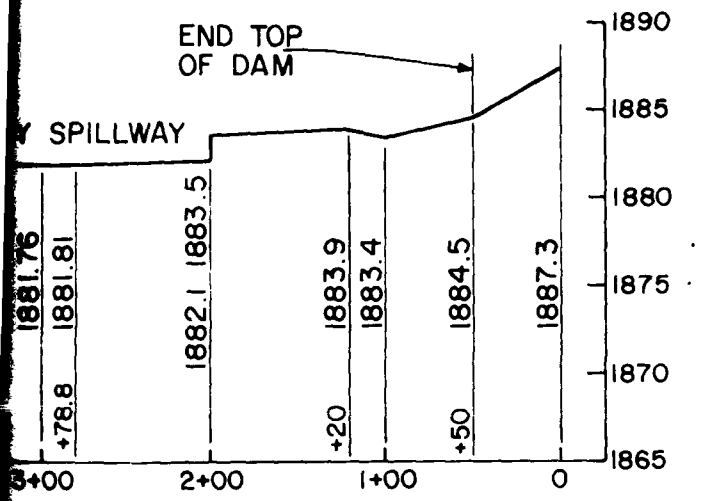
100 0 100 200 10

NOTE: PLAN, DRAWN OBTAIN SHOUL

PLAN

SCALE: 1 IN. = 100 FT.





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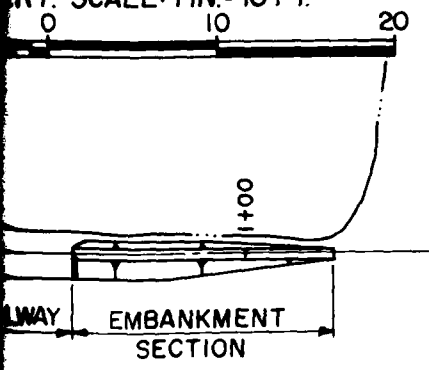
RT. SCALE: 1 IN. = 10 FT.



ROFILE AND SECTIONS WERE
ROM LIMITED SURVEY DATA
D FOR THIS INSPECTION. IT
NOT BE CONSIDERED DEFINITIVE.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

LYNCHWOOD LAKE DAM

LYNCH CORPORATION

PLAN, PROFILE AND SECTIONS

JANUARY 1980 PLATE E-2

APPENDIX F

GEOLOGY

LYNCHWOOD LAKE DAM

APPENDIX F

GEOLOGY

Lynchwood Lake Dam is located in Monroe County. The western half of the County lies within the Pocono Plateaus section of the Appalachian Plateaus Province and is separated from the Glaciated Low Plateau section of the same province by the Pocono Plateau Escarpment. The most pronounced topographic feature in the area is Camelback Mountain, which is a part of the Pocono Escarpment. The greatest relief along the escarpment is 1,000 feet, which occurs at Camelback Mountain. The escarpment has a well-defined southwestward trend from Camelback Mountain but is more irregular between Camelback and Mount Pocono, which lies to the north. Streams east of the escarpment drain directly into the Delaware River, while those to the west drain to the Lehigh River.

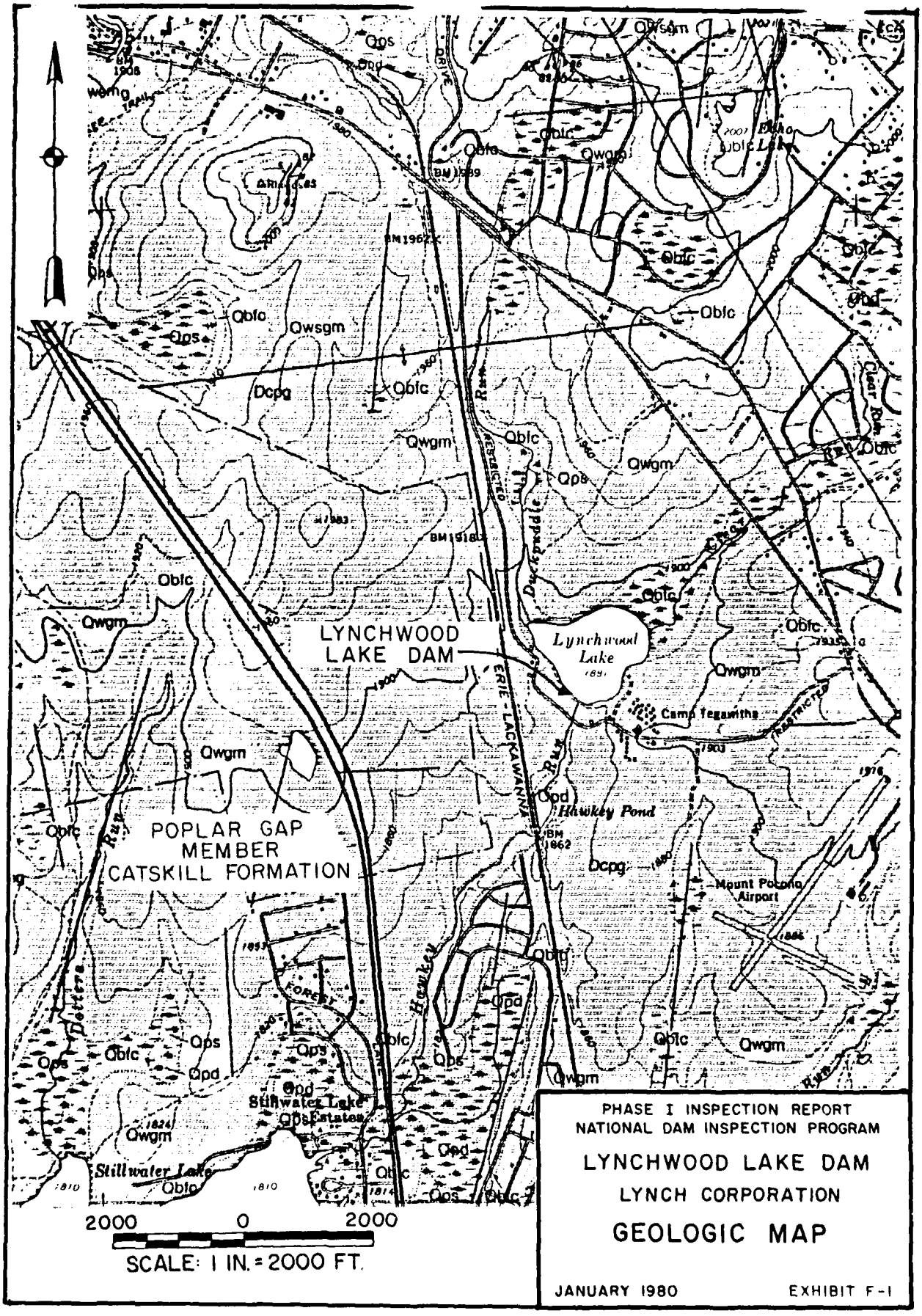
Lynchwood Lake Dam is located in the Pocono Plateau section of the province. The Pocono Plateau is relatively flat, with local relief seldom exceeding 100 feet. The topography is characteristic of areas that were glaciated during the Pleistocene Epoch; these characteristics include moraines, drumlins, eskers, kame terraces, glacial lakes and poor drainage, resulting in many swamps and peat bogs. The most striking glacial feature is the mile-wide, end moraine that crosses the plateau north of Interstate 80.

Lynchwood Lake Dam is underlain by the Poplar Gap Member of the Catskill Formation. The Poplar Gap Member is predominantly a gray sandstone and conglomeratic sandstone with interbedded silstones and shales. Sandstones present are thick-bedded, fine-to coarse-grained, and exhibit very low, primary porosity due to a clay and silica matrix. Effective porosity results from fractures and parting planes. Conglomeratic sandstone occurs primarily as concentrates of sub-round to round quartz pebbles. The siltstones and shales at the site are thin bedded and also have low porosity.

The rocks are well-indurated and generally are not susceptible to slope failure; however, the presence of well-developed bedding and joint planes will result in some rockfall from vertical and high-angle cut faces.

The bedrock is entirely overlain by glacial till of Late Wisconsin Age. This till is basically an unsorted mixture of clay, silt, sand, and gravel. It is moderately cohesive and is generally derived locally from the sandstones of the Catskill Formation. Thickness of the till varies from 5 to 75 feet.

The available records do not identify the materials upon which the dam is founded.



PHASE I INSPECTION REPORT
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LYNCHWOOD LAKE DAM
LYNCH CORPORATION

GEOLOGIC MAP

JANUARY 1980 EXHIBIT F-1